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MAR 28 1947

VOLUME LVII

MARCH, 1947

NUMBER 3

# THE LARYNGOSCOPE

FOUNDED IN 1896

BY

MAX A. GOLDSTEIN, M. D.

PUBLISHED BY

THE LARYNGOSCOPE

640 SOUTH KINGSHIGHWAY

ST. LOUIS (10), MO., U. S. A.

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# THE LARYNGOSCOPE.

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VOL. LVII

MARCH, 1947.

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## A REVIEW OF THE AVAILABLE LITERATURE ON THE LARYNX AND LARYNGEAL SURGERY FOR 1946.

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### HOARSENESS.

Some causes of hoarseness in children, or other faulty voice conditions in preadolescents or young adolescents, as stated by White,<sup>1</sup> have not received sufficient attention. He states that we all seem to expect to hear the "cracked" voice in boys, and have a tendency to laugh it off, and to assume that the lowering of the voice in girls is just part of the transition phase. Appropriate treatment, plus intelligent instruction in voice improvement, can frequently produce results which immeasurably improve the lot of these little sufferers.

It is interesting to note that about 8 to 10 per cent of the school children in the elementary schools, and about 8 per cent in the high schools, suffer from speech defects. Of these defects, hoarse voice is the most common. In general, more boys than girls are affected and among stutterers the proportion may be eight to one. About 50 per cent of the cases are seen by laryngologists.

In examining the children a definite plan should be followed as to age: Instability of nervous system first manifesting itself at puberty. Onset: Date and mode; Corrective meas-

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Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Feb. 18, 1947.

ures taken. History of infectious diseases, trauma and psychic shock. A complete family history especially concerning neuroses; Inciting causes. Congenital anomalies—malformation of larynx, that is, cartilage, muscles, choanae, jaws, innervation, cleft palate, harelip, tongue-tie. Inflammations: primary and secondary; mechanical obstructions. Hearing difficulties: unilateral or bilateral.

In his article, the author further states the ages range from seven to 18 years, with an average of 14 years. In his case reports, he definitely shows that many cases of hoarseness are caused by conditions far remote from the larynx, and it is only upon complete examination, both laryngeal and general, that the causes are found. Attention should be brought to the fact that all changes in the voices of children are not to be classified as a part of the physiological changes either before or during puberty. The lasting ill-effects not only to the larynx but also to the psyche of the person may be caused by failure to thoroughly investigate laryngologically all young persons suffering disagreeable changes in their voices. Much can be done to improve the speaking voice by cooperation between the laryngologist and the speech teacher. Also, an interesting aspect of this work has been the fact that so many children of various ages and nationalities could be examined by the indirect method of inspection. In other words, it can be done but it does take quite a little patience and, I might say, a little dexterity.

#### APHONIA.

McCaskey<sup>2</sup> defines aphonia as a loss of voice, but it is a loss of voice which is not due to a central lesion. His discussion is limited to functional aphonia, or perhaps a better term he would like to use is psychosomatic aphonia. He states that this type of aphonia has been, and is, more commonly referred to as a hysterical aphonia. The author states that if the term "hysterical aphonia" is used as the name of the disease, it would be well to set up a basis whereby a better understanding of this syndrome can be had.

It is necessary, of course, to examine the etiological factors

in hysterical aphonia. It is well to discuss the psychosomatic conception of hysteria, of which aphonia is one of the multitudes of symptoms, hysteria being a mental disorder which is always due to emotional causes and not due to organic causes.

When the basic mechanism in hysteria is analyzed, some type of conversion is most commonly found. By this it is meant that an emotional problem is converted into a physical manifestation. The individual is faced with the problem for which he is not able to find a satisfactory, efficient and acceptable solution at the moment. For this reason he hesitates to do the difficult or unpleasant act demanded by the realities of the situation, but he finds every other pathway of escape blocked because of criticism by society or by his own conscience. The author then gives an example of this condition.

The psychiatrists have found that individuals who have been badly spoiled in childhood, individuals who are emotionally immature and fundamentally childish in their attitude toward life, and similar types of self-indulgent individuals will often utilize this method of escape. It is frequently found among persons of a rather primitive and somewhat childish makeup, but, on the other hand, it has been noted among better integrated personality types under tremendous emotional experiences. More often, however, it is found in individuals who seem to have an insufficient ability to meet the ordinary vicissitudes of modern life.

The hysterical aphonia represents a specialized form of the previously mentioned mechanism. In this instance, the individual is unable to talk in a normal voice, or, if able to say a few words, his voice soon dies away to a whisper. There are numerous tests which otolaryngologists use to detect whether or not the presenting symptoms are organic, and they need not be enumerated here. If, however, the total situation of the patient is investigated carefully, and fairly, it will be found that the hysterical aphonia in some way symbolizes the problem and offers a solution to it. The author then gives a number of examples of this condition, after which

he states in his summary that in each of these instances the aphonia was merely representing the symptom of a major emotional disturbance and represented the only avenue of escape from a difficult dilemma. In this sense, the larynx became the organ of conversion of the psychological problem, and is not in itself the site of a pathological process. The treatment of functional aphonia must be directed toward the basic emotional problem. A direct attack upon the larynx with astringent drugs, galvanic current or other suggested measures may bring temporary amelioration but may cause the symptom to return at a later date or in a different form. The patient is no longer open to an attack upon the emotional problem because the otologist has, by his therapeutic procedures, tacitly implied that a laryngeal disturbance which requires organic treatment does actually exist. There can be no second chance, then, for emotional treatment because the patient who is anxious to hold on to his symptom then attacks the doctor with, he quotes, "But if there was no disease in my throat, why did you treat it?"

The author further states that the treatment of these cases of aphonia can often be carried out by an experienced, sympathetic and understanding otolaryngologist who is willing to listen to the patient's story and to help him understand the underlying factors which brought about his illness. Further in his summary the author states that aphonia is defined as a loss of voice, but it is a loss of voice which is not due to a central lesion. Second, this type of aphonia may well be called conversion aphonia because an emotional problem is converted into a physical manifestation. Third, this type of aphonia is a symptom and as such should not be treated locally. Also, an attempt should be made to find the emotional instability and see that it is corrected. This is a safe method of solving the problem. A psychiatrist, finally, is a very able adjunct in a great many cases of aphonia.

#### DYSPNEA.

Fox and Spencer<sup>2</sup> state that hemorrhage from the lower respiratory tract is a relatively rare occurrence in hemophilia.

Little stress, however, has been placed on the fact that involvement of the pharynx and larynx by blood extravasations beginning at or above these organs are not uncommon in these patients. Occasionally the extent of the hemorrhage may be such as to interfere with phonation, swallowing and even breathing. Hemophilic hemorrhages commonly follow muscular exertion. Even in normal persons, excessive and loud use of the voice may be accompanied by hemorrhage and edema of the larynx, which usually disappear with rest. These observations suggest that in hemophilic patients this type of hemorrhage may take an exaggerated form and progress to the point of producing serious obstruction to the air and food passages. The authors then cite two cases exemplifying the above description which demonstrated perhaps two different types of involvement of the larynx and adjoining tissues by edema and hemorrhage. The cause of the bleeding in one could be traced to overuse of voice. That hemorrhage so initiated may, in this location, constitute a serious threat is probably not recognized. It is understandable that, at first sight, an infectious process may seem to be the cause of the disorder. The lack of serious constitutional symptoms, and as in one case showed the absence of fever, indicated a noninfectious disorder. Deep seated hematomas in the neck region leading substantially to the same problem encountered in these patients have been fully described following dental extractions in the hemophilic. It has been reported that asphyxia and death may result in a hemophilic due to massive hemorrhagic infiltration of the floor of the mouth. The blood extravasated from the floor of the mouth and dissected downward through the base of the tongue in the plane above and behind the mylohyoid muscle and the hyoid, thus reaching the submucous tissues of the aryepiglottic region and thence the submucosa of the larynx.

Hematomas in the larynx may result from violent abuse of the voice, as in singing, shouting or screaming. These hematomas, which are not absorbed as a rule, if left alone become organized into a small, firm tumor that has been called a fibroangioma. A form of hemorrhagic involvement of the

larynx following violent and prolonged use of the voice has been described as "hemorrhagic laryngitis," though inflammation may or may not be present. The authors then state that it is wise, therefore, to include among the recommendations for the management of hemophilic patients that they refrain from excessive or strenuous use of the voice. This caution is in line with the usual recommendations against muscular excesses of any type in these patients. It is likewise important to bear in mind that a "hemorrhagic laryngitis" in a man may be a manifestation of a congenital or acquired disorder of hemostasis. Whenever possible, therefore, if the patient is hemophilic a small citrated blood transfusion should be given early. This would check the bleeding, prevent the spread of the hemorrhage and thus render a tracheotomy unnecessary.

#### ANOXIA.

Galloway<sup>4</sup> gives an outstanding description of the danger of unrecognized anoxia in laryngology, and he states that while in general the academic and theoretical aspects of oxygen want are well known, it does not seem equally true that the importance and serious limitations of anoxia are always appreciated especially under the stress of emergency. The author states that it has been difficult to establish the true histologic picture of damage from anoxia because the most notable injury is to brain tissue, and such changes occur as well with other acute circulatory and degenerative disturbances. He further states and describes authoritatively many causes of anoxia and their results, and states that it is not beyond controversy that the effects of carbon monoxide poisoning are due solely to lack of oxygen, so the many reports on this disease are not cited.

Anoxia results from defective oxygenation of the blood in the lungs due to *a.* low oxygen in the inspired air, as at high altitude, *b.* pulmonary abnormality, as obstruction, pneumonia, edema and atelectasis. He further states *2.* anemic anoxia—resulting from insufficient means of oxygen transport as an anemia or carbon monoxide poisoning; *3.* stagnant anoxia, in which there is poor delivery, although the hemoglobin may

be saturated, due to heart failure, obstruction of venous return, and shock; 4. histotoxic anoxia — resulting from the cells' inability to utilize oxygen, as in cyanide poisoning.

The article deals chiefly with the anoxic type as it is related to abnormalities of the respiratory tract. The symptoms of anoxia are important to have in mind, especially in dealing with conditions associated with similar manifestations. Mental symptoms occur early, such as depression, confusion, disorientation, irritability, unresponsiveness, lethargy and coma. Restlessness is an important early symptom both because the active patient increases his oxygen want and also because the unwary are too often tempted to attempt its relief by sedation, which may be followed by complete surrender by an overburdened respiratory mechanism. This is seen very often in little children suffering from acute laryngotracheobronchitis where they become restless due to want of oxygen.

Dyspnea is usually an early symptom, but may not be recognized easily in an exhausted patient or in one who has had sedatives. Cyanosis may be a late symptom of oxygen need since it may not occur while there is compensation by increased rate or depth of respiration, and increased rate and stroke output of the heart. If obstruction develops slowly, cyanosis may be a late sign, and the author believes that if severe cyanosis develops in acute tracheobronchitis of less acute onset, we are liable to have overwaited the indication for tracheotomy. In tracheobronchitis respiratory obstruction that develops an oxygen want causes the patient to become restless with further activity and increased oxygen consumption. It and its accompanying carbon dioxide accumulation lead to increased respiratory effort, increased negative thoracic pressure, increased congestion, exudate and even capillary hemorrhage, increased lymph flow and increased capillary permeability. This exudate leads to still further blocking of the bronchioles and the lung bed, with perhaps atelectasis and emphysema and deepening oxygen want. As this condition goes on, the respiratory center is depressed, the heart and respiratory muscles cease to function efficiently, due to oxygen need and the fight. In this condition, as in many other



conditions associated with anoxia, the physiopathology must be visualized almost from the start if it is not to become irreversible or leave tragic sequelae. Oxygen administration and other resources will relieve most cases of tracheobronchitis and respiratory obstruction, but no undue complacency should in progressive cases delay the certain and relatively safe relief by tracheotomy. The author pictures dramatically Negus' report on the instance of carbon dioxide need in his discussion of sudden death following successful tracheotomy. This article should be read by all who are interested in any type of asphyxia or anoxia, and to visualize the narrow margin between oxygen want and disaster. In the author's conclusion, he states that it is hoped that it will help save some anesthetized patient on the edge of dangerous anoxia from being throttled with sponge or instrument; or a sufferer from bulbar poliomyelitis from drowning in his own secretions; or another from struggling for air with a lung bed not functioning properly when that condition can be relieved. And may the picture be so clear that even in states of shock, exhaustion, cardiac failure or the like, where stagnant anoxia has already crippled the brain and the heart, there will not be permitted the further shutting off of precious oxygen by poor position or obstructed airway.

#### LARYNGEAL INJURIES.

In speaking of war injuries, Moffett<sup>5</sup> cites a few cases, one of which is a gunshot wound of the larynx in a male, age 26. The patient was wounded while lying on his face, the enemy fire coming obliquely from the left and in front. He was struck immediately above the right clavicle, and at once blood, which was not frothy, began to pour from his mouth. This soon ceased, but 10 days later he coughed up a thick clot of blood. Immediately after this, he found that on drinking, some of the fluid came out through the clavicular wound. This persisted for about 18 days. When first seen by the author, five weeks after the injury, his voice was hoarse and very weak, and he complained at that time of a pricking feeling, as if some foreign substance like a fish bone was in his throat. At the time



of examination by the author the wound above the center of the clavicle had nearly healed. A fibrous cord beneath the skin ran from this wound to the larynx, marking the track of the bullet. Nothing abnormal could be detected on palpating the larynx. An X-ray revealed a radio-opaque foreign body about one-quarter-inch square in the right shoulder region.

The larynx when first seen was considerably inflamed and edematous, the right cord had completely disappeared, and the anterior attachment of the left cord had moved over to the right side of the larynx. The right arytenoid was fixed, but the left cord was freely mobile and came well over to the right on phonation. The immediate surroundings of the larynx appeared normal. It was difficult to visualize the track of a bullet, apparently travelling in the opposite direction, entering the neck at the clavicle, penetrating the pharynx, removing one vocal cord neatly, and finally disappearing with scarcely any other damage to the larynx.

Another case of gun shot wound of the larynx in a male, age 31, was by a fragment of a Japanese hand grenade, which exploded about 20 yards from the victim. About two minutes after the injury he lost his voice, being able to speak only in a whisper. This was followed by difficulty in breathing and expectoration of blood, which lasted intermittently for eight hours. He then became comfortable. He was first seen by the author four days later. X-ray revealed no foreign body. The larynx was a little inflamed. Bruising was present in the right pyriform fossa, on the right aryepiglottic fold, on the false cord and on the posterior part of the right vocal cord. The mucous membrane everywhere appeared intact and devoid of swelling. He was put on absolute silence for a week. At the end of that time his voice had returned, but was still a little hoarse and some bruising remained. Four days later the voice and larynx were normal. The author states that it is probable that the grenade fragment causing the wound penetrated the larynx and was either expectorated or swallowed by the patient. The interference with the movement of the vocal cord was probably due to extravasation of blood and not to a nerve injury.

In still another case, of a self-inflicted wound of the larynx by a male, age 38, while in the delirium of typhus fever, this patient seized a sharp bamboo lath and endeavored to cut his throat. The result was several jagged wounds in the neck. One large wound had penetrated the cricothyroid membrane on the left side; a similar wound a little lower had entered the trachea. When first seen, the patient was gravely ill. The wound in the neck was septic and necrosis of the left ala of the thyroid cartilage had begun. An examination of the larynx showed it to be a little injected, with poor movement of the left vocal cord. The patient, breathing through his several airways, had no respiratory obstruction. His condition steadily improved. The anterior three-quarters of the left ala of the thyroid and his various wounds healed in about six weeks. An examination of his larynx at that time showed practically no abnormality during deep inspiration. On phonation, it could be noted that the anterior third of the left cord was fixed in abduction. When the arytenoids were approximated, the larynx was never completely closed, a triangular chink being left in the anterior part, with resulting weakness of voice.

The author reports an interesting case of an internal burn of the larynx in a male, age 25, who was badly burnt by the explosion of a truck load of cordite, on which he happened to be sitting, smoking. His two comrades seated beside him were killed instantly. He was seen by the author 12 days after injury, at which time he was very cyanotic. The cyanosis had a mottled appearance, and seemed to be confined to the upper part of his chest and neck. His face and lips were markedly swollen. Several superficial excoriated ulcers were present on the soft palate. The larynx was but little inflamed. A tiny ulcer was present on the edge of the epiglottis, and there were superficial ulcers, similar to those on the palate, on the left arytenoid and false cord. No edema of the larynx was present. The patient died two days later. The appearance of the larynx and the absence of any obstructing membrane in the larger branches of the bronchial tree was confirmed at post-mortem.

And lastly, the author reports a male, age 28, who was wounded in the neck and right arm by fragments of a Japanese hand grenade one month before examination. One fragment had entered the neck on the right side at the junction of the lower and middle thirds of the posterior border of the sternomastoid and lodged against the seventh cervical vertebra, causing a small fracture of the transverse process. The fragment was removed about six hours after wounding. Following this, the patient developed a right-sided pneumothorax, which took about two weeks to resolve. Immediately after the wounding, the patient found himself unable to use his voice properly, being able to produce little more than a hoarse whisper. At the time of the examination, his voice had recovered considerably, but was very variable in strength and rapidly tired after prolonged conversation. He considered that it was stronger when he had been sleeping on the right side, and weaker when he slept on the left. It had, however, shown a gradual increase in strength. He had a musculospinal paralysis on the right side and a small healed wound on the right side of his neck. His voice was weak and hoarse and very variable in strength. The throat and larynx were extremely difficult to examine; however, it did show a mild degree of laryngitis, both arytenoids being a little juicy. The right cord was stationary in the cadaveric position, but some movement of the arytenoid could be seen. The left cord moved well but lacked tension on phonation. Immediately after examination, the patient's voice improved considerably. The author believes that the paralysis of the right cord was no doubt due to an injury to his recurrent laryngeal nerve. The rapid improvement in his voice following examination suggested that much of his hoarseness and weakness had a functional basis.

Brown Kelly<sup>a</sup> presents an analysis of about 5,000 cases examined in the ear, nose and throat department of a Royal Naval Auxiliary Hospital, among which he states that there are only 2.3 per cent of cases due to diseases of the larynx, and in this series of cases the author mentions but one case of a fracture of the hyoid bone and thyroid cartilage; also, it is

interesting to note but 21 cases of a hysterical aphonia. The paper is very interesting; one case extended from September, 1939, to June, 1944.

Stenosis of the larynx is reported by Cardwell<sup>7</sup> in a 22-year-old pilot who stumbled on a foot locker and struck the front of his neck on an iron rail at the foot of his cot. He was breathless for a short time and bled from the mouth for about two hours. Examination at the dispensary disclosed no emergency, and he was transferred to the nose and throat clinic at the station hospital. He next morning he was still expectorating blood; this continued for two weeks, and he had had no voice since the accident. The larynx was tender and mirror examination showed diffuse edema and ecchymosis of the pyriform fossae and arytenoids obscuring the cords. A diagnosis of fracture of the larynx was made. Early administration of penicillin and palliative treatment failed to arrest the continuing edema and slowly increasing stenosis. The stenosis gradually increased until it was necessary to perform a tracheotomy, after which the author used a very ingenious method by using a mold made of clear acrylic that was trimmed to suit the needs of this particular larynx, with a loop of dental wire for a proximal handle, and a silk cord attached to prevent swallowing.

Wartime laryngeal injuries of the larynx, according to Lederer,<sup>8</sup> do not comprise the most frequent source of war casualties, but they do constitute one of the most serious forms of battle injury. In commenting on the treatment of laryngeal injuries, he states they may be divided into three phases: First or immediate phase transpires at the time of injury and is usually done under field conditions. In many instances an injury of the larynx is accompanied by profound shock out of all proportion to the apparent injury. The immediate concern in regard to a laryngeal injury is directed to maintain the patency of the airway. A prompt tracheotomy in such instances cannot be too strongly stressed. The second stage of treatment of the laryngeal injury may be said to last until the maximum amount of physiologic function and anatomic repair has been accomplished. The surgical treatment

of laryngeal injuries is varied, each patient presenting a different technical problem that must be worked out by the operator's own ingenuity.

The first step, which must be carried out before any surgical plan can be fostered, is direct laryngoscopy, in which the extent of the damage to the larynx is evaluated. The most frequent complication of laryngeal injuries is perichondritis. There is wide divergence of opinion as to the handling of this complication. It is generally agreed that if the perichondrium of the laryngeal cartilage has not been injured, recovery is rapid and distortion of the larynx is usually nil. If, however, the perichondrium has been injured extensively, as frequently happens in war traumas, there are usually perichondritis, abscess formation and necrosis, with resultant stenosis of the larynx. The author, therefore, recommends surgical intervention at an early stage in gun shot lesions of the larynx, with a view to preserving not only the skeleton of the larynx as much as possible, but also avoiding sepsis due to infected tissue adhering to the soft tissue. Pneumonia frequently follows laryngeal injuries, resulting from aspiration of blood and debris. Emphysema is a frequent complication, as air gains entrance into the soft tissue spaces. Infection and mediastinitis are feared complications and must be guarded against with the greatest care. The advent of mediastinitis is proclaimed by leucocytoses with a marked increase of polymorphonuclear cells. Penicillin should be given and cervical mediastinotomy performed when formation of a cervical abscess occurs. An injury of the esophagus should be attended to as soon as the condition of the patient permits further surgical treatment. Stenosis and web formation frequently follow laryngeal injury. If there is complete stenosis of the larynx, laryngostomy may be performed, the larynx laid open and the cicatricial tissue removed, care being taken not to damage the vocal cords if these are present. Stenosis of the upper part of the larynx may be treated by the use of core molds, which help to shape the interior of the larynx. Vitalium and tantalum dilators have been used recently with success. When the laryngeal box has been badly damaged with

the loss of tissue, distortion of the anatomic structures and permanent loss of vocal function, laryngectomy may be the operation of choice.

The subject of rehabilitation is too often overlooked in the plan of treatment. The average surgeon forgets that the larynx has two physiologic functions, one of respiration and one of phonation. The latter is frequently minimized. The successful processing of the patient in vocal rehabilitation as an adjunct to laryngeal surgical procedures was responsible for a great many cases returning to useful duty.

In his summary the author states that it is difficult to ascertain the number of laryngeal casualties. Statistics are difficult to obtain, and the anatomic description of death in the field frequently contains a description of multiple wounds without specifying the larynx as a site of injury. Deaths at sea are likewise not within the realm of classification. The author has chosen representative cases to illustrate the problems and the methods employed in meeting them. Similar traumatic influences will still confront the laryngologists after World War II, and their management should be one of general interest.

In further commenting upon injuries of the larynx in the World War, Canfield<sup>9</sup> gives a very interesting article concerning the workings of the Medical Department in the Army, as well as Hoople,<sup>10</sup> who gives his personal experiences during his tour of duty in the European theater of war.

#### TRACHEOTOMY.

Mosher,<sup>11</sup> in his paper, "My Milestones," speaks of his open tracheotomy, and that means that instead of the usual slit in the trachea, the actual removal of a circular piece of the front wall, with insertion of a tracheotomy tube. The author stated that he had spoken of this procedure at various meetings a number of times in discussions, but had never directly recorded it until Dr. Hill reported it fully and with due credit. The important point in the technique of the operation is to dislocate the isthmus of the thyroid downward, cut it and

suture the edge of each stump of the isthmus carefully so that all bleeding is securely and permanently controlled. In order to keep the front face of the trachea free, the halves of the isthmus of the thyroid are stitched firmly outward to the skin. The face of the trachea should be well exposed and the field dry before the patient is returned to bed. The author mentions that a theoretical objection to the removal of a section of the front wall of the trachea is the possible occurrence of stricture. He states that no such happening has been reported following the operation. He advocates the use of a very small bronchoscope in the trachea as a "life saver" and converts an emergency tracheotomy into a quite deliberate one.

#### PARALYSIS OF THE VOCAL CORDS.

McCall,<sup>12</sup> in his paper citing a preliminary report on the results of experimentation of nerve suture after vocal cord paralysis, states that paralysis of one vocal cord only does not endanger life. Voice weakness, voice change and frequent clearing of the throat characterize this condition. Pressure on the vagus or recurrent laryngeal from a tumor in the neck or mediastinum is a frequent cause of vocal cord paralysis. Paralysis of both vocal cords does endanger life, for if both cords are paralyzed, they assume the median position, closing the glottis. The paired posterior cricoarytenoids are the only abductor muscles of the larynx and when they are paralyzed the patient cannot open the glottis upon inspiration. If the cricoarytenoids do not open the glottis on inspiration, the flaccid cords are drawn closer together by the inspired current of air, causing the inspiratory crowing sound which is typical of bilateral abductor paralysis. Thus, it is an inspiratory dyspnea. The patient has no difficulty with expiration, as the force of the current of air is strong enough to separate the flaccid cords sufficiently to expel the air. He states, contrary to belief, that there is little voice change in bilateral abductor paralysis. There is not as much voice alteration in bilateral vocal cord paralysis as in unilateral paralysis because in bilateral paralysis the vocal cords assume the median position.



Thyroid disease and the sequelae of thyroidectomy are the most frequent causes of bilateral paralysis. In their experiments they attempted to short-circuit an injured recurrent laryngeal nerve by anastomosing the vagus to the recurrent peripheral to the lesion. If such an anastomosis could be accomplished, they state it would render a mutilation of the larynx unnecessary, and restore the normal function of the vocal cord. Accordingly, the anterior median parts of the vagus nerve are sutured to the distal stump of the recurrent to get some, at least, of the fibres originally constituting the recurrent branch of the vagus, so that regeneration of a sufficient number of motor nerve fibres will occur for a return of motor innervation of the larynx.

The problem of innervating the laryngeal muscles in the experimental animal presents two questions: First, can the suture of the nerves and the regeneration of motor nerves to the muscles be accomplished within a sufficiently short period of time? Second, can the central nervous system readjust so as to properly regulate the control of the laryngeal muscles through a new set of nerve fibres?

Jory<sup>13</sup> comments that it is the rule with our British colleagues that they advocate a permanent tracheotomy in these bilateral abductor paralyses following thyroid operations.

In the treatment of this condition, Woodman,<sup>14</sup> in a preliminary report of a modification of the extralaryngeal approach to arytenoidectomy for bilateral abductor paralysis, states the procedure: if a preliminary tracheotomy has not been done, the patient is prepared under local anesthesia for the placement of a semirigid woven silk intratracheal tube under guidance of the laryngoscope. A tracheotomy should then be done before starting the operation. Intravenous induction of anesthesia has proved satisfactory. An incision is made along the anterior border of the sternocleidomastoid muscle at the level of the upper edge of the thyroid cartilage and is carried down to the level of the cricoid cartilage. The sternocleidomastoid muscle is retracted, exposing the posterior edge of the lateral thyroid cartilage, with the thyrohyoid



muscle anterior to its posterior edge and the inferior pharyngeal constrictor muscle attached to its posterior edge and to the inferior cornu. The attachment of the inferior cornu to the cricoid cartilage is a key landmark. A vertical incision is made along the posterior edge of the lateral thyroid cartilage and the inferior cornu down to and through the perichondrium. The inferior constrictor is separated posteriorly; the cartilage is hugged closely and the perichondrium elevated around the posterior edge and on its mesial side sufficiently to free it of inferior constrictor attachments. The facet-like joint between the inferior cornu and the cricoid cartilage is then separated, and the incision is carried through the perichondrium on the lateral wall of the cricoid cartilage and continued vertically upward until the cricoarytenoid joint is encountered. The joint is not separated until the subperichondrial dissection of the arytenoid cartilage had been accomplished. When the latter has been done, the joint is disarticulated, and all of the arytenoid is removed except that small anterior nonarticular free part closely associated with the vocal process. A curved needle with chromic gut is passed around the vocal process, care being taken to keep it in the submucosa and to pass it through and include some of the fibres of the vocalis and the thyroarytenoideus muscles. The cord is then drawn laterally and sutured to the inferior cornu of the thyroid cartilage and in turn is reinforced by anchoring the suture to the anterior edge of the sternocleidomastoid muscle. Before the wound is closed, the larynx is inspected with the laryngoscope and careful note made of the position of the cord. Closure is then made by bringing the inferior constrictor muscle back into place with a few separate sutures, interrupted sutures close the skin, a Penrose drain being left in the lower end of the wound, which is removed in 48 hours.

"Laryngeal Neurosis Incident to Military Service," by Rise-man,<sup>15</sup> gives an account of 17 patients under observation for prolonged hoarseness of rather sudden onset. He states that sensory disturbances, such as paresthesia and hyperesthesia, were not encountered. Only one of the patients had experienced combat duty, all others having been stationed continu-

ously within the continental limits of the United States since their induction or enlistment. His conclusions are that laryngeal neuroses exists as a definite clinical entity; that mental or emotional conflicts are the etiologic basis of the voice changes; that the clinical laryngeal findings are not constant, the most frequent finding being dysphonia plicae ventricularis; that the therapy consists chiefly of dissolution of the individual's basic mental conflict; and that a high percentage of patients can be returned to full military duty after proper therapy.

Holinger,<sup>10</sup> in reporting feeding tube stenosis of the larynx, states that the indwelling nasal tube, employed chiefly for gastric decompression or for feeding purposes, is so widely used that it is important to draw attention to the possibility of laryngeal damage it may produce. Instances of this complication are relatively uncommon, but, when they do occur, constitute a difficult therapeutic problem. He states that the indwelling tube in the cases to be discussed was the cause of erosion of the anterior esophageal wall at the level of the cricoid cartilage, with subsequent inflammation of the laryngeal cartilages and their ultimate necrosis. This pathological sequence led to a collapse of the airway and a severe chronic laryngeal stenosis which required tracheotomy and months or years of subsequent treatment. This discussion is presented to call attention to this serious complication and to stress the predisposing as well as exciting etiological factors responsible for it. Through an understanding of these factors, the recognition of early symptoms and the prompt execution of simple corrective measures will prevent the development of this type of chronic laryngeal stenosis. The author further states that in presenting this condition as a cause of stenosis of the larynx it should in no way be construed as a condemnation of the use of the indwelling stomach tube; however, if during its use, the patient complains of a sore throat or pain in the neck radiating to the ears, or if hoarseness is noted, the tube should be removed. If the condition of the patient does not permit the removal of the tube, its position at the level of the larynx should be changed, noting that there is an actual change by

visualization with the laryngeal mirror. It would seem likely that this type of ulceration and subsequent stenosis is not more common because in most instances the tube does not pass directly between the cricoid cartilage and the cervical spine, but descends laterally on either side of this point. Active treatment of laryngeal perichondritis, once it has developed, is exceedingly difficult and often disappointingly ineffectual. Chemotherapy, both the sulfa drugs and penicillin should be administered, although none of these patients was in the acute stage when penicillin was available and consequently no clinical experience can be recorded. The editor has seen four of these cases of feeding tube stenosis of the larynx as demonstrated or cited by Holinger.

#### STRIPPING OF THE VOCAL CORDS.

Since Loré<sup>17</sup> has completed his experimental work on stripping of the vocal cords, he reports 100 patients having been operated on, and cites others that have tried this operation with satisfactory results. His indication for the stripping, generally speaking, is that any benign growth lends itself to this operation. The degree of stripping will depend on the extent of the lesion or lesions. The benign growths in the present series have been single or multiple polypi, as well as extensive polypoid degenerative changes of both cords, simple papillomas, single or multiple, blood tumors and nodes. Malignant growths include hyperkeratotic papillomas and most observers believe that these growths are precancerous; a safer and saner view is to consider them as cancerous, since, if not eradicated, they develop into extensive carcinoma and cause death.

He further states that it is with considerable reluctance and misgiving that carcinoma of a vocal cord is mentioned in connection with this stripping operation, and it must be distinctly understood that the author does not advocate this procedure as the method of choice. He then describes fully and very carefully the operation, and in his summary states that the experimental stripping of the vocal cords in cats established the fact of vocal cord regeneration. Hyperkerato-

tic papilloma can be cured by this operation. General anesthesia supplemented by local anesthesia induced by the application of a solution of such anesthetic drugs as cocaine hydrochloride or tetracaine hydrochloride is the anesthesia of choice. the operative technique described has proved satisfactory, and the postoperative management with silence or whisper is questioned. Better end-results have been obtained by permitting reasonable use of the voice. The functional results have been uniformly good and the satisfactory results obtained warrant the continued application of the principles of this operation.

#### SCLEROMA.

Mendiola,<sup>18</sup> describing histopathology of scleroma of the upper respiratory tract, states that scleroma is an endemic disease of the upper air passages. The bacillus of von Frisch, which lives as a parasite on the tissues, has been considered its pathogenic agent, although it has not been definitely established that this is the real causative organism of this disease.

The characteristic lesion of scleroma starts and progresses very slowly. It appears most frequently among the poorest classes. The inflammatory lesion usually starts in the nose and secondarily involves the rest of the upper air passages, attacking progressively muscle, cartilage and bone. The point of predilection is the upper lip, from which it extends upward to the nasal septum, turbinates, cavum, pharynx, larynx and trachea, finally reaching the main bronchi. Patients usually go on living in good general health for a long time. Scleroma remains, with no tendency to ulcerate, and there are neither glands nor lesions in any other organs. Functional disturbances depend upon the regions affected. Consequently, nasal obstructions, disturbances in the hearing, dysphagia and dyspnea are more or less accentuated. The different stages of the development of the lesion are present simultaneously, so that it is possible to observe chronic granuloma, either plain or nodular, and cicatricial lesions in the same region. These pathological changes account for the clinical symptoms of obstruction and rigidity of the air passages. The clinical

diagnosis can be confirmed by taking a biopsy to be examined histologically or bacteriologically.

#### SCHWANNOMA.

Turchik<sup>19</sup> states that a Schwannoma is an encapsulated, nodular, slowly growing, vascular, usually benign, tumor arising within or on the side of a nerve trunk and is believed to originate from the cells of the neurilemma, or the sheath of Schwann. It may grow to a large size, but it is painless in character and gives symptoms due to pressure. After complete removal, recurrences are rare.

He reports a case which is unique in that, in retrospect, one can see that the tumor caused a paralysis of the right vocal cord five years before a tumor mass was ever recognized or considered. He reports a case of Schwannoma of the pharynx, with its point of origin definitely located in the vagus nerve at its exit from the jugular foramen. This case plus two other cases showed unilateral paralysis of the vocal cord. The author states that Schwannomas are rare tumors in the pharynx, attain a large size and cause extensive damage by pressure, and that only seven cases have been reported in the literature. Accurate elicitation and evaluation of the signs and symptoms preoperatively should permit an early diagnosis of this lesion prior to its appearance in the pharynx. He states also that early operation utilizing the safer external approach, lateral pharyngotomy, advocated by Orton, should eradicate the tumor and avoid the troublesome complications so frequently encountered.

Violé,<sup>20</sup> also, in speaking of Schwannoma of the pharynx, relates that among other relatively rare developments, Schwannoma of the pharynx takes a prominent place as an interesting example of benign tumor. Though this growth is not limited to the head and neck, these are the areas more frequently involved. In describing his case, he states that the tumor mass extended into the nasopharynx and also into the hypo-

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[Editor's note: This type of operation was used by me successfully on the same type of case about 15 years ago.]

pharynx. And he further states that the extreme rarity of Schwannoma of the pharynx is indicated by the infrequency of the reports in the medical literature. It is generally accepted that this tumor originates in the cells of Schwann, it being a peripheral nerve growth. While bearing many characteristics in common with carotid body tumor, it must be carefully differentiated from this cervical growth, as well as from pharyngeal lymphosarcoma. He states that aspiration biopsy is recommended as being less hazardous than operative biopsy. Diagnosis cannot be established clinically; histologic study must be the determining diagnostic procedure. Horner's syndrome as a concomitant of the tumor, while still very rare, would seem to be increasingly observed, perhaps due to the greater use of the present-day neurosurgery as well as to the increase in traffic and industrial accidents. Age and sex seem to have no recognizable bearing on the occurrence of this growth. Radiation is contraindicated, as being ineffectual in small doses, while intensified treatment may prove hazardous to adjacent tissues. The tumor is a benign growth, invariably slow in developing, it does not metastasize, and no recurrence is reported following excision.

#### LEIOMYOMA OF THE LARYNX.

Neivert<sup>21</sup> states that a leiomyoma, or smooth muscle tumor, has been described by all pathologists and is encountered frequently in the uterus, ovary, prostate, bladder, iris, alimentary tract, skin, etc., but his case was a man, 75 years of age, complaining of difficulty in speaking and breathing for 16 years, both symptoms having become progressively more pronounced during the past few months. Difficulty in swallowing developed shortly prior to his admission to the hospital. He was elderly, emaciated and anemic, and his speech was hardly intelligible. Examination of the ear, nose and throat gave negative results except for the larynx. Under indirect laryngoscopy, a large, round, smooth mass, completely filling the vestibule, could be seen. Large blood vessels could be visualized on the surface, and the mass appeared to originate in the right aryepiglottic fold. Laminagrams of the larynx,

together with a lateral view of the neck, showed evidence of a rounded, soft mass of tissue occupying the vestibule of the larynx. It seemed to arise on the right side in the region of the aryepiglottic folds, but did not appear to involve the vocal cords. A tracheotomy was done to relieve dyspnea and in anticipation of further surgical treatment. The operative procedure—with the patient under intravenous pentothal sodium anesthesia, a horizontal incision was made on the right side of the neck just below the hyoid bone. The deep fascia was opened. Bleeding from superficial vessels was controlled by clamping and electrocoagulation. The thyrohyoid muscles were cut so as to obtain a better view. The right submaxillary gland was liberated and retracted upward. After the thyrohyoid membrane had been incised, the tumor mass, which was the size of a walnut, was seen. The membranous envelope of the cystic mass was then incised, and the tumor itself was removed by blunt dissection. The mass was oval in shape and firm and had a smooth surface. Alongside of the right edge of the tumor mass, the hypopharyngeal space was exposed. This exposure was then closed with chromic catgut sutures. A rubber drain was left in the cavity created by the removal of the tumor mass. The thyrohyoid muscles were sutured. The fascia was also sutured with catgut. The right superior laryngeal artery was tied, and the skin was then closed with silk sutures. A feeding tube was inserted in the esophagus. The diagnosis of histological study was a leiomyoma vascular type of the larynx of the aryepiglottic fold. The author states that the significance of this first true leiomyoma of the upper part of the larynx reported in American literature is scientific rather than clinical.

#### LARYNGOCELE.

Campbell<sup>22</sup> reports that a review of the literature on this subject leaves one with a confused idea of the actual status of the true laryngocele and of the number of cases that have been observed and reported. He cites the case of a man, age 38 years of age, who complained of having an intermittent sore throat for many years. Three months ago, he noted a



small swelling in the left side of his neck that was not related to eating or drinking, but usually became enlarged after a bout of coughing. At the time of the patient's admission, it had reached the size of a hen's egg. Pressure on the soft swelling gave the patient the sensation of air escaping in the throat, associated with a squealing noise. On examination, a visible tumor that rose with swallowing was located in the anterior superior triangle of the left cervical region. The size varied from that of a tangerine to that of a hen's egg. It was soft and compressible and could be collapsed with a squealing sound when the patient's mouth was open. A deliberate effort to inflate the laryngocele by closing the mouth and nose was not successful, but inflation required a series of swallowings. During these thyroid excursions, the tumor was observed to inflate. Indirect and direct laryngoscopy revealed nothing abnormal. An unsuccessful effort was made during compression to find the hole that allowed the air to escape. The Roentgenologic report included an anteroposterior and a lateral view of the cervical part of the spine, showing a cyst-like tumor, approximately 6x4x4 cm., located on the left side of the neck at the level of the hyoid bone. The lesion was filled with air and displaced the larynx to the right. Fluoroscopy of the upper part of the esophagus with barium administered by mouth failed to reveal any communication between that part of the esophagus and lesion. The patient was operated on by an external route and the gross description of the specimen consisted of a fluctuant mass of tissue measuring 4x3x1.5 cm. Its base broadened out when it was laid on a flat surface. A small opening was noted at one end of the mass. A small pair of scissors was used to open this tract, which extended into a large thin-walled cavity containing turbid fluid. The cavity was lined with a smooth, moderately injected membrane. The author comments that laryngoceles may be divided into three classes: first, the internal, a cystic dilatation within the larynx; second, a superior external, a cystic dilatation of the sacculus of the ventricle of Morgagni that penetrates the thyrohyoid membrane just above the upper rim of the thyroid cartilage and anterior to the superior cornu, or just lateral to the thyroid notch; third, a combination of the first two.



The foregoing report of laryngocele conforms to Class II and the condition may be described as a superior external laryngocele.

#### KERATOSIS OF THE LARYNX.

Clerf<sup>23</sup> emphasizes that epithelial hyperplasia of the larynx may assume all gradations from simple diffuse thickening in chronic inflammation to localized keratosis, papillomatous masses which fill the larynx or carcinomatous ulceration with extensive invasion. As a result, difficult problems in diagnosis are encountered.

The frequent association of keratosis with chronic laryngitis suggests long continued irritation as a predisposing cause. Studies in food deficiency diseases indicate that keratosis is often a manifestation. It has long been observed that keratinization of the skin is related to disturbances in vitamin A metabolism. Clinical observations have long shown that many tumors arise from tissues that were once normal, and various forms of chronic inflammatory changes are observed to precede the appearance of many tumors. This brings up the interesting and much debated question of whether keratosis or any form of benign epithelial hyperplasia may be considered as a so-called precancerous lesion. From the pathologist's standpoint, they describe the whitish elevations on the vocal cords as small masses of hyperplastic squamous epithelium, which at times are suggestive of papilloma, but the usual characteristic arrangement is lacking. The basement membrane is commonly regular, sometimes pushing into the submucosa in small, irregular projections so that it becomes difficult to decide whether there is infiltration or whether the process is merely a part of the hyperplasia. In most instances, a good basal layer of epithelium is observed. The keratinization varies in different persons. The laryngoscopic appearance and the extent of the keratotic lesions may vary. There is commonly but one symptom; namely, change in voice. This may consist only of slight huskiness, or the voice may be hoarse. Occasionally there may be clearing of the throat. In conclusion, the author states that while

keratosis is often observed in association with carcinoma of the larynx, the cases cited exhibited evidence of keratosis of the larynx from two to four and one-half years from the time the first observation was made until a diagnosis of carcinoma was made. In addition, it was known that keratosis was present for eight months in one case, two years in another and three years in still another case before the patients were examined. It is evident, therefore, that the patients had keratosis in the beginning and that carcinoma developed later. While there is no evidence to indicate that the keratotic cells ultimately assumed a malignant character, there is justification for the statement that patients with keratosis of the larynx should be carefully observed, because in a certain proportion of cases carcinoma will develop. And in his conclusion the author states that it is more often observed in adult males and particularly in those who smoke excessively. Clinical observations indicate that although keratosis *per se* is benign, there are a certain number of keratoses that either become carcinoma or predispose to its development. Patients with keratosis of the larynx should be kept under close observation; the involved areas should be removed and all tissue examined histologically. The author further states that if there is any question of the occurrence of carcinoma, more radical surgical intervention is indicated.

#### GRANULOMA.

Kearney<sup>24</sup> reports a case of bilateral granuloma of the larynx following intratracheal anesthesia. Intratracheal anesthesia has been used now for many years and in many thousands of cases by hundreds of anesthetists. It has been a boon to both surgeon and patient, and many surgical procedures would be impossible without it, particularly in thoracic surgery. Its benefits greatly outweigh its few undesirable sequela. One of these sequelae is polypoid granuloma of the larynx. These lesions are traumatic in origin, and in prophylaxis, therefore, trauma should be avoided. Tubes for intratracheal anesthesia should be made with a very smooth surface. They should be stiff enough to maintain an airway, but sufficiently flexible to

avoid trauma. The tube should be carefully selected for size for the individual patient, and it should be gently introduced through a relaxed larynx. Granuloma of the larynx following intratracheal anesthesia is most likely to arise from the vocal cord in the region of the vocal process of the arytenoid cartilage. The removal of a pedunculated laryngeal tumor is easy and leaves a very small raw surface. It seems advisable, therefore, if the airway does not become dangerously inadequate, to allow these growths to become pedunculated before they are removed.

#### PENICILLIN.

In the past few months, as Smith<sup>25</sup> states, penicillin has become more available and it has been used in the average run-of-the-mill cases. Penicillin is a specific agent, effective only against certain organisms, but since these organisms include the pyogenic cocci which are most frequently responsible for the troublesome and serious infections in otolaryngologic practice, it is of particular value in this field. Because it is a specific agent and not a panacea, it is necessary to determine the bacterial nature of every infection against which it is used. In cases of cellulitis of the neck, penicillin has been of value for this type of infection. Penicillin appears to be an effective agent in the treatment of Ludwig's angina.

Penicillin has been used very effectively in the treatment of Ludwig's angina and cellulitis complicating the application of dental surgery.

Also, Kimberg<sup>26</sup> reports a case of Ludwig's in which penicillin seemed to have a very beneficial result in conjunction with surgery.

Berger<sup>27</sup> states that penicillin is a powerful bactericidal and bacteriostatic agent, surpassing the sulfonamide drugs in its power to combat certain infections and to promote the healing of wounds. It is to be used in sulfanilamide-resistant conditions. Much more extensive scientific research is necessary to reveal its further clinical applications.

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[Editor's note: This, I believe, should be in conjunction with surgery.]

According to Hinshaw,<sup>28</sup> the search for drugs effective in treatment of tuberculosis has long been under way, but significant progress toward a practical goal was not achieved until the modern era of chemotherapy reawakened interest in the subject.

Streptomycin has been used very effectively in treatment of ulcerating tuberculous lesions of the respiratory passages, including the larynx, hypopharynx, trachea and large bronchi. Observations are still incomplete, but improvement of the patients has been observed in some of the cases under observations and recurrences have not been noted, although treatment has been completed for a year or more in a few cases. Treatment of ulcerating tuberculous lesions of the hypopharynx, larynx, trachea and bronchi may include both parenteral and aerosol treatment with streptomycin. The aerosol was administered by means of a nebulizer in a manner similar to that employed in bronchiectasis. For this, 20 cc. of isotonic solution of sodium chloride which contains 0.5 gm. of streptomycin is used; 2 cc. are nebulized into the mouth each hour for 10 hours of the day. Streptomycin for prolonged periods, as is required for tuberculosis, has produced reactions which, although incompletely understood, must be anticipated. The most frequent and uncomfortable reaction observed in the author's experience was disturbance of equilibrium. Other toxic manifestations previously described may be due to impurities in the streptomycin. Irritation at the site of injection is widely variable and inversely proportional to the purity of the product. Renal damage is not likely to occur, but until clinical studies on the prolonged use of purified preparations of streptomycin have been completed, it is recommended that renal functions be observed closely.

In many instances, streptomycin appears to suppress tuberculosis rather than to eradicate it, being apparently bacteriostatic rather than completely bactericidal in the concentrations which can be obtained in the tissues. Streptomycin is recommended for more extensive trial in treatment of many forms of pulmonary and extrapulmonary tuberculosis because of definitely and consistently encouraging results attendant

on its use in a series of cases in the past few years. Treatment of tuberculosis requires large doses of streptomycin, 1 to 3 gm. a day for prolonged periods, and should not be undertaken unless adequate amounts are likely to be available to complete a course of at least two to four months' duration—total requirements up to 360 gm. Toxic manifestations should be anticipated in a majority of patients in whom such prolonged treatment is carried out. Disturbance of equilibrium is especially likely to occur and often persists for at least several weeks after the discontinuation of the streptomycin therapy. Treatment with this antibiotic should be postponed or denied to those tuberculous patients who are making satisfactory progress and who are likely to achieve the arrest of their diseases as a result of conventional therapeutic methods. Streptomycin is not to be regarded as a substitute for other and proved effective forms of treatment of tuberculosis.

#### TUBERCULOSIS OF THE LARYNX.

In any tuberculosis institution the treatment of laryngeal tuberculosis occupies a prominent rôle in the therapy of this dreaded disease. Humphries<sup>20</sup> states that the relationship of laryngeal tuberculosis to pulmonary tuberculosis is now better understood, and this knowledge has served to lessen the incidence of laryngeal complications and to assist in their eradication after they have appeared. The surgical treatment, as directed to the larynx, has likewise made progress, and the beneficial results are now more uniformly obtained.

Concerning medical treatment, the author believes that in those cases of incipient laryngeal disease with hoarseness and irritative cough, soothing sprays are indicated. Of course, voice rest is one of the greatest aids in obtaining healing and should be prescribed in all cases. As to the surgical treatment, it is limited to galvanocauterization. This is never used in cases where the lesion is minimal, except to destroy interarytenoid tuberculomas or vegetations. After thorough cocaineization of the larynx, several punctures are made with the electrode in the diseased sites. It is best to have the electrode

at white heat. Care must be taken not to overdo, and technique must not allow puncture of the cricoarytenoid joint or the insertion of the needle into the muscular areas, as healing may bring stenosis. The procedure of laryngoscopy is sometimes necessary for the removal of tuberculomas. It is the consensus of opinion that the base of any tuberculous tumor should be lightly cauterized to prevent local spread. Biopsy has been necessary in several cases in which a differential diagnosis was made, as one patient had intrinsic tuberculosis as well as squamous cell carcinoma. The removal of the epiglottis surgically is seldom done. Pain is generally abated by proper use of the cautery; however, epiglottectomy with punch or snare can be done under local anesthesia. Block of the internal branch of the superior laryngeal nerve was carried out in a few cases and the author feels it is advisable particularly in the advanced extrinsic, painful cases unrelieved by cauterization. The author further states that the nerve should never be resected. Tracheotomy because of edema resulting from too extensive use of the cautery seldom occurs. Tracheotomy should never be done to put the larynx at rest, as this is not obtained. The cases that the author had undertaken were having marked laryngeal obstruction from ulceration and edema, but he would like to emphasize that the three major objectives in the treatment of tuberculosis of the chest and larynx are: first, to free the sputum of tubercle bacilli; second, rapid healing of the chest lesion, with disappearance of the symptoms; and third, rehabilitation of the patient. The present study indicates that these objectives are accomplished in a greater percentage of patients than ever before. The influence of collapse therapy upon the laryngeal lesion is evidenced by the low percentage of patients having this complication. The use of electrocautery in 23 per cent of the 139 cases presented in the last five-year study, with marked relief in more than 90 per cent, emphasizes its value in our therapeutic armamentarium.

Auerbach,<sup>30</sup> in speaking of the incidence of laryngeal tuberculosis, stated that during a period of five and one-half years there were 811 cases of tuberculosis which came to autopsy.

Of these, 304, or 37.5 per cent, showed evidence of laryngeal involvement. As to age, he mentions the fact that the youngest person in their series was a patient 15 months of age, while the oldest was 82 years of age. In all but two instances it developed as a direct infection from positive sputum in chronic pulmonary tuberculosis. The age, sex and race distributions in this series parallel those in chronic pulmonary tuberculosis. Tuberculosis foci, with and without central zones of caseation, form in the walls of the larynxes as a result of tubercle bacilli which enter through the ducts of the mucous glands. Ulceration develops either through pressure atrophy of the mucous membrane by the tuberculous foci or by caseous necrosis of the overlying epithelium as the tuberculous areas enlarge. The further progression of the ulcerative process is similar to that in other parts of the body. Ulcers were found most frequently on the true vocal cords in 47.1 per cent. Healing may occur in any stage of anatomic development, usually in cases in which underlying chronic pulmonary tuberculosis undergoes anatomic healing. In some instances healing and progression keep pace in the same larynx, resulting in a pronounced thickening of the wall, nodular protrusions into the lumen and narrowing of the canal.

Hulse,<sup>31</sup> in speaking of the treatment of tuberculosis of the larynx, states that electrocautery is far out in front in the modern methods of attack on laryngeal tuberculosis. Electrocautery may be said to have two main functions: first, the destruction of diseased tissues; second, a local stimulation of tissues due to the resultant hyperemia. Just what part each plays in a given case cannot be determined with any degree of accuracy. Placing a local portion of the body at rest is, of course, the intention of collapse methods, and the application of this principle to an infected larynx is of no less importance. Many of the movements of the larynx cannot be controlled, but the most important one, that of talking, can easily be. It will be noticed that under rest alone, the larynx is capable of resolution even in the presence of pulmonary regression. The author states that a casual review of the



older as well as the more recent contributions in the literature devoted to this subject will reveal that there are many more therapeutic suggestions than those mentioned; these have not been considered here, inasmuch as their value is largely historical and they contribute little, if anything, to the modern picture of successful laryngeal therapy. Only a few years ago, the complications of tuberculosis which occurred in the field of otolaryngology were in the hands of the phthisiologists. In the past decade, more attention has been given to these complications by those who should be better qualified to handle them, the otolaryngologists. The gradual decline in the incidence of extrapulmonary tuberculosis should be considered as mute testimony of greater diagnostic and therapeutic skill in pulmonary therapy. By the same token, the fact that laryngeal tuberculosis can show resolution under rest alone speaks eloquently for modern collapse methods and for those who administer them. And he states that it is by no means felt that all patients with laryngeal tuberculosis should rely solely on collapse methods for total therapeutic support. Rather, he wishes to point out a therapeutic synergism as well as the need for cohesion in therapy of the upper and the lower respiratory system in tuberculosis.

Figi,<sup>32</sup> in the treatment of tuberculosis of the larynx, relates that tuberculosis of the pharynx or larynx complicating pulmonary phthisis is extremely serious since it indicates lessened resistance on the part of the patient or increased virulence of the infecting organism, or both; moreover, the severe pain associated with tuberculosis of the larynx or pharynx tends to lower the patient's morale, interferes seriously with ingestion of fluids and nourishment, and thereby adversely affects the ultimate prognosis. And he states that in the treatment of cases of tuberculosis of the pharynx and larynx, streptomycin was given both by parenteral injection and by inhalation of nebulized aerosol. The dose which was administered parenterally varied from 0.5 to 2 gm. — 500,000 to 2,000,000 units of streptomycin hydrochloride per 24 hours. This quantity was divided into eight equal doses and one of these was injected subcutaneously or intramuscularly every



three hours. For nebulization, 0.5 gm. of streptomycin hydrochloride was dissolved in 20 or 30 cc. of physiologic saline solution and 2 or 3 cc. of this were administered at the beginning of each hour for 10 hours each day. The author, in conclusion, states that in four cases the lesion of the pharynx and larynx had become progressively worse up to the beginning of treatment with streptomycin. In addition, the general health of three patients had deteriorated for from two to several years preceding treatment with streptomycin.

The lesions in the throat for which streptomycin was administered were of three distinct types. Included were, first, an indolent verrucose tuberculoma; second, multiple superficial, painful, moth-eaten ulcers of the hypopharynx; and third, an extensive destructive ulcer of the epiglottis. The prognosis in this third type of lesion is generally bad. He states that while this series is too small to permit us to draw any definite conclusions, it is interesting to note that amelioration of the symptoms referable to the throat occurred promptly in all of these cases; moreover, it preceded evidence of improvement in the general condition and appeared to have a direct bearing on this. The prompt relief from the acute soreness and pain in the pharynx and larynx suggests the possibility that secondary infection was partly responsible for these symptoms. It is of interest, also, that the ulcers of the pharynx and larynx healed and showed no tendency to recur even in those cases in which tubercle bacilli continued to be present in the sputum. He states that further observation will be necessary in order to determine the ultimate effect of treatment with streptomycin on the pulmonary lesions in these cases.

Hinshaw<sup>33</sup> emphasizes what has been said above, and further states that the most frequent and uncomfortable reaction observed in some of his cases is the disturbance of equilibrium. With other toxic manifestations, irritation at the site of injection is widely variable and inversely proportional to the purity of the product. Treatment with this antibiotic should be postponed or denied to those patients who are making satisfactory progress and who are likely to achieve the

arrest of their disease as a result of conventional therapeutic methods. Streptomycin is not to be regarded as a substitute for other and proved effective forms of treatment of tuberculosis.

Myerson,<sup>34</sup> in the treatment of tuberculosis of the larynx, mentions a sulfanilamide spray, in which he states that a few cases have been treated with sulfathiazole powder and penicillin nebulized with oxygen, or in an aqueous solution as a spray. The objection to sulfathiazole is that it cakes because it is not soluble, while the objection to penicillin is that it is more expensive more difficult to prepare, more difficult to keep and readily contaminated.

He states that the use of sulfanilamide in cases of secondarily infected tuberculous ulcerations of the larynx can convert a hopeless case into one in which there is a chance. As a result of the elimination of pain and the restoration of the ability to swallow, the patients gain weight and strength, becoming greatly improved. He further states that he does not claim that the use of sulfanilamide powder insures a cure. He does feel, however, that many patients who succumb to extensive and active tuberculous disease of the lungs and other organs can be spared much of the pain which is so frequently associated with involvement of the larynx. Some lives will be prolonged, some will be saved, but, whatever the outcome, many will not experience the agonizing pain and the inability to swallow which has always accompanied tuberculous ulcer of the larynx. The author states that the sulfanilamide used in each application to the larynx is about 5 to 10 gr. This is sprayed into the larynx with a powder atomizer. The tongue is held forward by the patient while compression of the rubber bulb or compressed air forces the fine powder into the larynx. The stem of the atomizer has an adjustable tip which can be bent downward so as to direct the powder spray into the larynx.

#### CANCER OF THE LARYNX.

The statistics of the American Medical Association<sup>35</sup> state that in the United States cancer of the larynx has caused

1,490 deaths. The Chicago Board of Health stated that in 1944 there were 75 deaths from cancer of the larynx. In England, cancer of the larynx caused 1,206 deaths. The point above merit is that these forms of cancer are curable in their early stages. The figures cited, therefore, indicate grave shortcomings in clinical cancer service, and that many agencies are now urging on the public and the medical profession the vital importance of early diagnosis with prompt, adequate treatment of cancer. Increasing stress is being placed on the need of more modern facilities for cancer service. States, cities and other communities, as well as closed groups like the Veterans' Administration, and their death certificates of cancer have an invaluable index of the efficiency of cancer service. In the methods of treatment of carcinoma of the larynx and their results, New<sup>30</sup> states that teamwork is essential between the surgeon and the pathologist in the diagnosis of precarcinomatous and malignant lesions of the larynx. Teamwork among the surgeon, the anesthetist, the surgical assistants and the nurses in both the operating room and the hospital is necessary if the operative mortality rate is to be kept low. Teamwork between the surgeon and the radiologist is indispensable if all the patients are to get the best possible care.

Under the diagnosis of carcinoma of the larynx, he states that this condition is being diagnosed earlier today than in the past, due to the fact that physicians in general recognize that hoarseness may mean carcinoma and that the disease is curable. A specimen for biopsy should be taken only by the surgeon who is going to operate on the patient, since if it is removed by someone else before the surgeon sees the patient, it is often difficult for the surgeon to determine the extent of the lesion. Such a circumstance could jeopardize the patient's chance of a conservative operation. Complete removal of the neoplasm is essential in any operative procedure. Certain conservative operations are justifiable in the treatment of carcinoma of the larynx, as is shown by the end-results in certain selected cases. Selection of the cases for conservative treatment, however, should be made only by a laryngologist

who has seen a great deal of laryngeal disease. Small epitheliomas of the vocal cords, of low grade malignancy, can be removed by surgical diathermy under suspension laryngoscopy with good results. The author further states that carcinoma of the epiglottis can be removed orally. Even in some cases in which the neoplasm involves the aryepiglottic fold and the lateral wall of the pharynx, the oral approach is advisable. He states that thyrotomy is done for epithelioma of the larynx which involves the anterior three-fourths of the vocal cords, when the epithelioma is of low grade malignancy. Surgical diathermy is used in all such cases. Laryngectomy is used for growths that are fixed and which by their fixation give evidence that the muscle is involved. Also, for highly malignant tumors, laryngectomy should be performed if there is any question of the extent of the lesion. He also states that carcinoma of the larynx is a curable disease if the teamwork advocated at the beginning of his paper is applied.

LeJeune,<sup>37</sup> speaking of his experience with an intralaryngeal operation for cancer of the vocal cord, states, in very, very carefully selected cases that the advantages of an intralaryngeal extirpation are: first, the simplicity of operation; second, no external incision; third, preservation of continuity of the thyroid cartilage; fourth, better postoperative phonation; fifth, shorter hospitalization; and sixth, good results. He describes his technique of operation and states that he has operated on 39 patients with early intrinsic carcinoma of the vocal cords by the intralaryngeal route and electrocoagulated the base of the lesion following the operation. Nineteen of these patients have survived the five-year period after which they are considered "cured." Fifteen patients are living and well from one to five years after operation. Two patients have been operated on so recently that no result can be given now. Three patients have had recurrences; two required laryngofissure, and one later required laryngectomy. In this latter patient, he states that 11 years after an intrinsic tumor of the left vocal cord had been successfully removed by intralaryngeal dissection, a tumor developed on the opposite vocal

cord which, when first seen, showed fixation of the cricoarytenoid joint with involvement of the entire right side of the larynx. He concludes his paper by stating that complete eradication of the malignant lesion with maximum preservation of organic function of the larynx is ideal, and in early cordal cancers this can be achieved by intralaryngeal extirpation of the tumor.

Now, coming from the conservative method of treatment of carcinoma of the larynx, Brunschwig<sup>38</sup> goes to the opposite extreme of radical surgery and calls his procedure a panlaryngectomy, and in principle the operation consists of resection en masse of the larynx, base of the tongue, upper 3 to 4 cm. of trachea below the larynx, and the upper portions of each thyroid lobe and anterior portion of most of the cervical esophagus. The muscles inserting on the thyroid cartilage, as well as those of the infrahyoid group, are resected with the above; they are transected as far away from their thyroid cartilage and hyoid attachment as possible. The chain of cervical lymph nodes on each side are dissected from below upward in such a manner that they are freed from all connections except those attaching them to the thyroid cartilage and adhering muscles. In this fashion, he states, they are removed en masse with the latter.

The author states that he is prompted to do this operation by the continued very pessimistic attitude generally existing in regard to advanced or extrinsic laryngeal carcinoma, especially when there have been recurrences following more conservative procedure, and/or when there has been a failure of control following irradiation therapy. The author concludes by stating: "while the series of patients here considered is not a very large one, it would appear that after failure of the more conservative operative procedures or irradiation therapy, there is still something to offer these patients if the process has not extended beyond the neck."

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[Editor's note: This procedure is very similar to that of Bissi, of Buenos Aires.]

## SARCOMA OF THE LARYNX.

Clerf<sup>30</sup> reports a series of eight cases of sarcoma of the larynx and states that the frequency of sarcoma of the larynx, based on cases reported during the past two decades, would indicate that it is uncommon, although earlier writers believed that it formed about 10 per cent of malignant neoplasms. Sarcoma is a disease of adult life and is commoner in men. The ages vary from 25 to 75 years, with five patients in the fifties and one patient of 49 years. One of these patients, the author states, had been observed and treated, however, 30 years previously for a similar lesion, at which time he was 21 years of age. Although many histologic varieties may involve the larynx, the commonest form is fibrosarcoma. Fibrosarcoma does not metastasize early and usually grows slowly, but local recurrences are observed if the primary lesion is not removed completely. The rapidity of growth varies; local recurrences may grow more rapidly than the primary lesion. The author reports four cases of fibrosarcoma, one of fibro-osteosarcoma, chondrosarcoma, lymphosarcoma and extra-medullary plasmocytoma. The symptoms of sarcoma are those common to all laryngeal neoplasms and depend on the location and size of the tumor. Hoarseness is a common early symptom and was observed in seven cases. Dyspnea usually occurs late and in the large cordal lesions is progressive. The diagnosis often is not easy. The pedunculated form may be confused with an inflamed fibroma. The absence of ulceration suggests a benign tumor. Biopsy often is not satisfactory, as the overlying mucosa may be normal. Increasing dyspnea indicative of rapid enlargement and the absence of ulceration should suggest sarcoma. The treatment of sarcoma of the larynx depends on its size, situation and activity. Thyrotomy is especially useful in the treatment of sarcoma of the larynx. And the author states that on the basis of a study of reported cases and personal experiences, it would appear that fibrosarcoma of the larynx should be treated surgically and that complete removal is necessary. A majority of these can be removed without sacrifice of the larynx. An open operation is desirable unless the tumor is pedunculated.

Colledge,<sup>40</sup> in speaking of speech following laryngectomy, states that the essential point was that patients must produce vowel sounds if they were going to talk intelligibly. The vowel sounds were produced in the larynx and the consonants by the lips and tongue. He further states that if patients just whispered, the sounds which they produced were without vowels and were largely unintelligible. He did not think that it was either feasible or necessary to train them before the operation.

#### RADIOTHERAPY.

Radiotherapy in the treatment of cancer of the larynx has of late been of questionable value in some parts of the country and very enthusiastically received in other parts. Cutler<sup>41</sup> states that the main point of issue is under what circumstances radiotherapy should be used for operable cancer of the larynx. More specifically, the following questions were discussed: First, should radiotherapy be preferred to surgical treatment for early carcinoma of the true cord amenable to laryngofissure? Second, should radiotherapy be preferred to surgical treatment for operable intrinsic carcinoma of the larynx when the disease is so far advanced as to require total laryngectomy? In his criteria for selection of treatment by radiation, he mentions that the choice between laryngectomy and irradiation is difficult. Despite the fact that most patients adjust themselves to the loss of the larynx, irradiation is preferable if the chances of cure are equally good. The following criteria for the selection of treatment are based on the work at the Chicago Tumor Institute: He states that the lesions which are extrinsic by origin or by extension are generally regarded as inoperable. Any condition which indicates a short life expectancy, such as advanced age, cardiac disease, advanced arteriosclerosis, diabetes and pulmonary tuberculosis, should influence the decision against laryngectomy.

[Editor's note: Speech following laryngectomy should always be a part of the postoperative care of a laryngectomized patient.]

[Editor's note: These two criteria in my estimation might be open to quite a discussion, although it may be admitted that in a second stage of the tuberculosis, diabetes, etc., might be applied against laryngectomy as a poor operative risk.]



The author concludes his paper by stating that laryngectomy should be limited to intrinsic lesions with complete fixation of the cords occurring in good surgical subjects of good life expectancy. He states, also, that it is reasonable to expect that further improvements in the technique of irradiation and earlier diagnosis will further diminish the necessity of total laryngectomy.

[Editor's note: But it seems that today the reports of total laryngectomy and longevity of the patients following such procedures at the present time far surpass the results by irradiation.]

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## STUDIES ON ORAL PENICILLIN.\*

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Almost from the moment of its discovery, there has been interest in the oral administration of penicillin. Early investigators<sup>1</sup> found that it was rapidly destroyed by the gastric acidity; however, the work of Rammelkamp and Helm,<sup>2</sup> administering penicillin to patients with achlorhydria, showed that absorption of the biologic agent from the gastrointestinal tract was possible. This finding led to renewed activity to discover a means of accomplishing this in normal subjects. In past months many articles have appeared substantiating the oral use of penicillin<sup>3,4,5</sup> and giving ample clinical evidence of its effectiveness against pathogenic bacterial infections when administered in this manner.<sup>6,7,8</sup>

The advantages of the oral route of administration need no elaboration. The procedure of administering the antibiotic in company with a chemical, or mixture of chemicals, to neutralize the gastric acidity has been rather generally adopted. This has led to the development of several commercial products containing penicillin, usually as the calcium salt, combined in a tablet or capsule with an acid-neutralizing agent. One of these products was made available to us for use in patients with infections of the ear, nose and throat. The preparation we used contained 25,000 Oxford units of calcium penicillin combined in a tablet with a mixture of aluminum hydroxide, calcium carbonate, and magnesium oxide of sufficient quantity to neutralize approximately 80 cc. of N/10 hydrochloric acid.<sup>9</sup>

In order to control our clinical studies, we followed the level of penicillin in the blood serum, and tested the organisms cultured from the patients for sensitivity to penicillin. For this we used the "flat plate" method described by Cooke.<sup>10</sup>

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Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Nov. 28, 1946.

This method consists essentially in determining the lowest concentration of penicillin which will produce complete inhibition of growth of a standard strain of staphylococcus on tryptose agar plates. For determining the blood serum levels, 0.1 cc. of serum is used, spread over an area on the plate of 10 sq. cm., and the ability of this serum to inhibit growth of

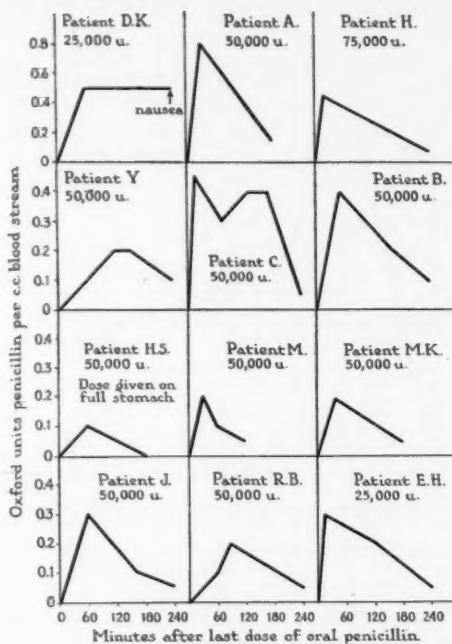


Chart 1.

staphylococcal organisms of known sensitivity is observed. The organisms used were subcultures of the standard strains, "S. M." 209-N and 209-W, from the Food and Drug Commission.<sup>11</sup> The material used for standardizing the method in our laboratory, and for all tests of sensitivity of organisms, was dried calcium penicillin of known Oxford potency.<sup>12</sup> For

determining the sensitivity of an organism, the bacteria are first isolated in pure broth culture; then the inhibition of growth on tryptose agar plates is observed, using standardized solutions of penicillin.

Determinations of blood serum levels of penicillin were made in 12 patients. The dose, and the time after the dose at which the penicillin level was determined, was varied. The results are illustrated in Chart 1. None of the patients stud-

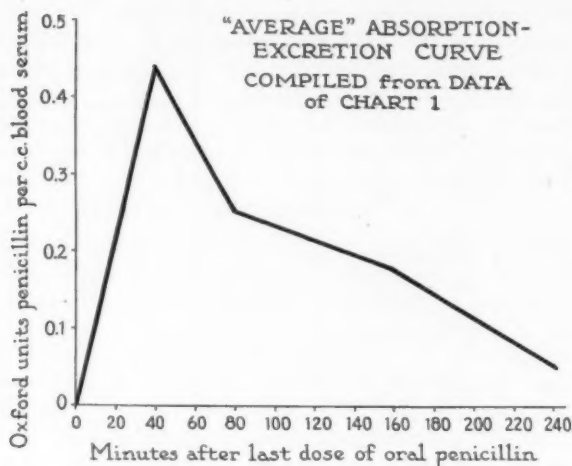


Chart 2.

ied were achlorhydric. In all patients except one, the penicillin was administered on an empty stomach. In the patient to whom the drug was given after meals, the levels were significantly lower but sufficient to be therapeutically effective. Chart 2 illustrates the average of our experience with the oral administration of varying doses of calcium penicillin. We found that the oral route of administration requires doses of penicillin three to four times greater than the intramuscular route. The average adult dose should be 50,000 Oxford units every two to three hours. After such a dose of penicil-

lin, the blood serum level rises in the first 30 to 60 minutes to 0.2 to 0.4 Oxford units per cc. of blood serum. The penicillin is excreted at a rate which permits maintenance of blood serum levels of 0.1 to 0.2 Oxford units for two to three hours after the last dose. Penicillin levels of this magnitude are, in our experience, therapeutically effective; for this is eight to 10 times greater than the sensitivity of the pathogenic organisms found in our patients. In children, the dose

ORGANISMS	SENSITIVITY IN U PENICILLIN PER CUBIC CENTIMETER
<i>N. sicca</i>	0.03
<i>Streptococcus viridans</i>	0.03, 0.03, 0.02, 0.04 0.03, 0.03 <u>Aver.: 0.03</u>
<i>N. catarrhalis</i>	0.06
<i>Staphylococcus albus</i>	0.10, 0.02
<i>Staphylococcus aureus</i>	0.04, 0.06
<i>Streptococcus hemolyticus</i>	0.04, 0.03
<i>Pneumococcus</i>	Type 8 - 0.02    Type 11 - 0.02 Type 13 - 0.03    Type 19 - 0.02 Indeterminate - 0.02, 0.05 <u>Aver.: 0.025</u>

Chart 3.

of penicillin was reduced to 25,000 units and found clinically satisfactory. None of these patients suffered gastrointestinal symptoms.

In the course of these studies a considerable variety of the organisms generally found as pathogens in the nose and throat were encountered. The sensitivities of these organisms varied somewhat, as noted in Chart 3; however, all of the organisms cultured were susceptible; and the most resistant strain found was a staphylococcus albus which was sensitive to 0.10 U. Most of the pathogens were sensitive to 0.03 to 0.04 U. This is eight to 10 times less concentration of penicillin than achieved in the blood on average doses of the drug by the oral route.

The patients treated ranged in age from three years to 61 years; 13 were males, 12 females. In Chart 4 an attempt was made to evaluate the clinical response of each type of case. Eight patients treated presented the picture of acute upper respiratory tract infections with marked malaise, fever and normal or low leucocyte counts. On cultures from the nose and from the throat no pathogenic organisms were grown. These patients have, therefore, been suspected of having a virus infection. The value of the oral penicillin in these

DIAGNOSIS	NUMBER OF CASES	CLINICAL RESPONSE				UNFAVORABLE REACTION
		EXCELLENT	GOOD	POOR	DOUBTFUL	
PANSINUSITIS	2	1	1			
MAXILLARY SINUSITIS	2		1		1	
TONSILLITIS	4		2	1	1	
LARYNGITIS	2		2			1
PHARYNGITIS	4		3	1		2
OTITIS MEDIA	2	2				
VINCENT'S ANGINA	1		1			
VIRUS INFECTIONS OF RESPIRATORY TRACT	8	PROPHYLACTIC VALUE 6			2	

Chart 4.

cases cannot be ascertained; but as none of this group developed purulent complications, it is believed that oral penicillin may be of some prophylactic value in such cases.

The following case represents the manner in which the clinical material was handled and the steps taken to obtain the foregoing data.

H. S., a 13-year-old girl, developed a sore throat and pain in the left ear 12 hours before she came to clinic. The ear had begun to drain pus six hours before her arrival in the clinic. Examination revealed an acutely inflamed upper respiratory tract, a normal right drum, and a red, thickened left drum, perforated anteriorly and draining purulent material. The temperature was 100.2° F. Culture from the left ear isolated a staphylococcus aureus which was found to be sensitive to 0.06 U. penicillin per cc., and a pneumococcus, Type 8, which was sensitive to 0.02 U. of penicillin per cc. The throat culture revealed only



the Type 8 pneumococcus, and we feel that the staphylococcus found was probably a contaminant. This girl was given oral penicillin, 50,000 U. every three hours for eight daily doses. The blood serum level of penicillin one hour after such a dose was found to be 0.1 Oxford units per cc. serum, and two hours after this dose the level had fallen to 0.05 N.; however, in 24 hours, having taken 400,000 U. of penicillin by mouth, the girl felt much better, had no pain in the left ear or her throat, and her temperature was 99.8° F. The drainage from the left ear had decreased markedly. On the third day she felt well, her temperature was normal, and the drum was gray although there was a small amount of discharge present in the canal. On the fourth day, the left drum was healed, the patient felt well. Oral penicillin was discontinued, and the patient remained well. This girl received 400,000 U. of penicillin in eight daily doses for each of four days. Although her serum levels for penicillin were never high, and not well sustained, the difference of five times between the serum level and the sensitivity of the infecting organisms made for a good clinical response.

Along with the rather encouraging therapeutic responses to penicillin by mouth, we experienced three cases in which untoward reactions of sufficient severity to warrant discontinuing the drug occurred. One patient, a 55-year-old male, had never received penicillin in any form previously. After receiving 250,000 U. by mouth in 48 hours, he developed a papuloerythemoid eruption over his hands and forearms, and erythema and edema of the skin of the "butterfly area" of the face. This was accompanied by severe itching. The skin manifestations receded in 24 hours after stopping penicillin, but the itching continued for 48 hours longer. A second man, 52 years old, also had never received penicillin in any form previously. This man received 75,000 U. of penicillin every three hours. One hour after the first dose he noticed that his groins were red, swollen and burned. In two hours the "butterfly area" of his face was red, swollen, and there was marked edema of the eyelids. In spite of this reaction, he took a second and third dose of 75,000 U. before he was advised to stop. In 12 hours after the first dose, his eyes were swollen shut, and the edema of the groins had extended into the penis and scrotum and there was edema of the larynx. The penicillin was stopped, 1 cc. of adrenalin 1/1,000 in oil, was given subcutaneously, followed by ephedrine sulfate gm. 0.02 every three hours for four doses. In the next 24 hours all edema of the skin had subsided. The burning and itching continued with diminishing intensity for 72 hours longer. The third patient was a physician, aged 48 years. He

had received penicillin\* by injection intramuscularly three weeks before (that was his first experience with penicillin). During this first course of penicillin, on the fourth day, he had developed erythema of the face and groins, with itching, after 120,000 U. of the drug. Upon attempting three weeks later to take penicillin by mouth in doses of 50,000 U. every three hours, he had a recurrence within eight hours of erythema of face and the right groin. This lasted, along with marked itching, for 72 hours after withdrawal of the drug, and without other treatment.

This third patient probably represents a "produced sensitivity" to penicillin. In the other two cases, there was no known allergy, and neither patient had previously received penicillin. These two patients apparently present an "inherent sensitivity" to the drug. That such reactions can occur has been reported previously.<sup>6</sup> It seems important that the patient be under rather close observation while receiving penicillin by any route, inasmuch as these reactions can and do occur regardless of the route of administration, and are of sufficient severity to require special treatment in some instances.

Evaluation of the success of chemotherapy of any kind must be cautious; therefore, in studying the oral use of penicillin in otolaryngology, we have attempted to determine whether the pathogenic organisms generally encountered were sensitive to penicillin. This we have found to be true. We have encountered no case of drug fastness in our studies. It has also been possible to determine that oral penicillin is absorbed from the gastrointestinal tract in amounts sufficient to be effective against pathogenic bacteria. In general, the more dramatic results were obtained when the blood stream level of penicillin was the greatest as compared with the sensitivity of the organism involved. We found that large doses of penicillin were necessary to obtain such levels. Usually a patient required three to five times as much penicillin by mouth as was required to obtain the same level if the drug were given intramuscularly. As has been suggested by the Cornell group,<sup>13</sup> we feel that a large dose of penicillin is nec-

essary for effective oral therapy. We have little evidence that it is essential to accompany the large dose of the drug with an antacid, nor have we found any particular antacid superior; however, it is possible to give enough penicillin orally to get sufficiently effective levels of the drug in the blood to combat unusual infections of the ear, nose and throat. In cases with extremely severe infections, the *oral* use of penicillin is contraindicated. We have also observed untoward reactions to oral penicillin in sufficient numbers and of such severity as to warrant considerable caution in administering this drug.

In summary, we present our experiences with the oral administration of calcium penicillin accompanied by an antacid preparation. We have found that in doses of 25,000 to 50,000 units every two or three hours the penicillin is absorbed from the gastrointestinal tract in sufficient quantities to produce a therapeutically effective blood serum level of the drug. This level is five to 10 times that of the sensitivity of most pathogenic organisms found in the nose and throat. Because of the relationship between absorption and the sensitivity of organisms, it has been found practical to treat many of the infections occurring in the field of otolaryngology by the oral administration of penicillin. In treating 25 patients, three examples of sensitivity to the drug have been encountered of sufficient therapy to warrant discontinuing the penicillin therapy.

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#### SUMMER COURSE IN AUDIOMETRY AND FITTING OF HEARING AIDS.

During the 1947 Summer Session the Departments of Speech, Psychology and Otolaryngology of the State University of Iowa are again offering an intensive four weeks' course in Audiometry and the Fitting of Hearing Aids. The course will run from June 23 to July 19 and is open to anyone meeting college entrance requirements.

A series of week-end lectures and round table discussions on various aspects of hearing conservation will be featured as a part of the summer program. Mrs. Spencer Tracy, Director of the John Tracy Clinic, Los Angeles; Dr. Helen Lane, Principal, Central Institute for the Deaf, St. Louis; Dr. Werner Mueller, Associate in Otolaryngology, Massachusetts Eye and Ear Infirmary, Boston, and Harvard Medical School; and Dr. Martin F. Palmer, Director of the Institute of Logopedics, the Municipal University of Wichita, Kan., will be the speakers.

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## CHANGES IN THE COLOR OF THE PHARYNX FOLLOWING SMOKING.

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### INTRODUCTION.

Various observers have attempted to determine the effect of smoking by observing changes in the appearance of the pharynx. Flinn<sup>1</sup> and his collaborators recorded visual estimations of changes. Ballenger<sup>2</sup> and his collaborators attempted to match the colors with the Tallqvist color standards for hemoglobin. Proetz<sup>3</sup> investigated the possibility of estimating colors of the throat by visual observation and found that there was no agreement among a group of observers on inflammation of the pharynx and concluded that such methods of color estimation are futile. In an attempt to put the observation of colors on an objective basis, Kopetzky and Hirschfeld<sup>4</sup> used a colorimeter employing a photoelectric tube (electric eye) to measure the intensity of light reflected by the pharynx when illuminated by a standardized light source. These investigators employed this instrument to evaluate the relative effects on the pharynx of smoking cigarettes treated with glycerine and cigarettes treated with diethylene glycol. In view of the fact that their readings on the throat showed a consistently lower reflectance following the smoking of glycerine treated cigarettes than was observed following the smoking of diethylene glycol treated cigarettes, they concluded that the former were more irritating. This conclusion was based on the assumption that decreased reflectance implied increased redness which was taken as evidence of increased irritation.

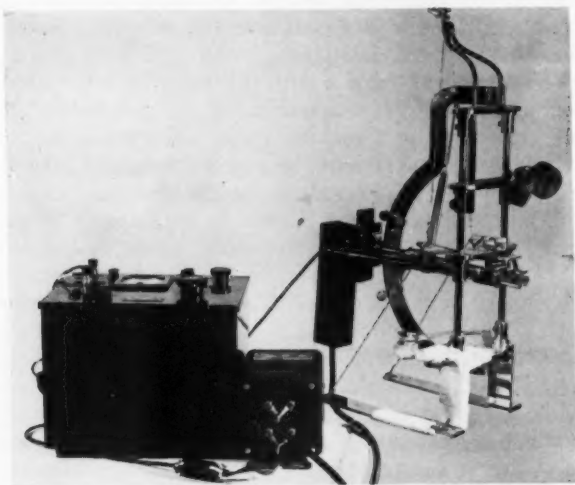
The object of this investigation was to repeat the work of Kopetzky and Hirschfeld, employing such improvements in apparatus and technique as occurred to us.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Nov. 23, 1946.

## METHODS AND APPARATUS.

The apparatus as originally constructed was substantially a duplicate of that described by Kopetzky;<sup>4</sup> however, as will be noted below, some modifications were made in order to increase the precision of the measurements. The apparatus as finally developed is shown in the accompanying photograph.

The colorimeter basically consisted of a standardized light source operated from a constant voltage transformer, a photo



tube (Type 929), and a meter for measuring the current of the photo tube. The light source consisted of a one candle-power 6-8 volt lamp mounted in a tube carrying a small lens which permitted the light beam to be focused on the pharynx. The photo tube was mounted on a similar tube in the same horizontal plane as the light tube. The angle between these two tubes was adjustable. A slide mounted in front of the photo tube permitted the darkening of the photo tube and the use of filters. The first photometer used by us was presumably the same type used by Kopetzky and Hirschfeld;

however, preliminary experiments with this instrument indicated that readings obtained with it were unreliable. Consequently, a photometer was designed and constructed which was not subject to the difficulties experienced with the earlier instrument.

It was recognized by us at the outset that a film of moisture on the surface being measured could have an important effect on the reflectance readings obtained with the colorimeter. Preliminary experiments showed that most of the specular reflectance resulting from this film of moisture can be eliminated by the use of polarizing screens in front of the light source and also in front of the photo tube. Consequently, such screens were installed and used in this investigation. As a result of these changes, it was found possible to obtain the same readings repeatedly on color standards and the zero drift was practically non-existent. One adjustment at the beginning of the experimental period of approximately four hours was usually sufficient so that readjustment during the period was not required. It should be noted, however, that while the instrument was perfectly stable in locations where no stray currents occurred, some difficulty was experienced due to stray currents resulting from various pieces of high voltage equipment. This difficulty was obviated by connecting the instrument to a ground wire.

In addition to the standardization of the instrument at zero light intensity, the sensitivity of the instrument was standardized by measuring the reflectance of a standard surface. The surface used consisted of a small block of wood which had been coated with a red lacquer and rubbed to a matte finish. This standard was prepared approximately two months before it was used in order to insure a stable surface. In using the color standard on the instrument, it was clipped to a small box which was constructed to fit onto the light and photo tube tubes. The distance from the light and photo tube tubes to the color standard was approximately the distance from the upper front teeth to the pharynx. In using this color standard the sensitivity adjustment on the meter was set so that a scale reading of 100 was obtained. This reading



did not change during an experimental period of three to four hours although adjustment was necessary from week to week to compensate for the slight loss in illumination due to ageing of the lamp bulb. Since the color standard was set at 100 the readings on the pharynx corresponded to the percentage reflectance of the pharynx with relation to the color standard.

The methods employed in the smoking tests differed in detail from those used by Kopetzky. The latter recorded one reading on the subject's pharynx, had a subject smoke for about 15 minutes and at the end of this smoking period a second reading was taken. The experimental routine followed by us was as follows: The subject was instructed not to smoke for at least an hour prior to the test, and upon reporting, a series of four readings on his pharynx was taken. These readings were made at about 10 second intervals with the instrument removed from the subject between each reading. The subject was then told to wait for 15 minutes and at the end of this period a second series of four readings was taken in the same manner as the first. The subject was then supplied with the test cigarettes and instructed to smoke continuously for 15 minutes. At the end of the smoking period, another series of four readings was taken in exactly the same manner as the previous two series. The reasons for this change in procedure were as follows: The series of four readings at short intervals was made to determine the reproductivity of the readings on the assumption that no changes occurred in the subject during the short period required for these readings. The 15 minute presmoking interval was used in order to determine whether or not any spontaneous changes occurred in the subjects during a period identical with and immediately preceding the smoking period.

The subjects smoked only one type of cigarette during a given experimental period; however, the type of cigarettes used during a period was alternated for the different subjects so that while each subject smoked both types of cigarettes, one-half of them smoked glycerine treated cigarettes during their first session, and the other half smoked diethylene glycol treated cigarettes during their first session.

The cigarettes employed in the experiment were manufactured for us by one of the large cigarette manufacturers in his regular production equipment. They were made in the presence of one of us (C. W. L.) and the only difference between the two lots was in the identity of the hygroscopic agent used. The two lots were coded with the names "car" and "tin" and contained 2.74 per cent diethylene glycol and 3.65 per cent glycerine respectively. The concentrations of humectant employed were those reported by Mulinos<sup>3</sup> to represent normal commercial practice. During the period of the experiment the cigarettes were stored in a humidity chamber maintained at 50 to 55 per cent relative humidity by a saturated solution of calcium nitrate.

The subjects used were hospital employees and as such may not necessarily represent a true cross section of the population. Individuals with acute upper respiratory infections or sore throats were not used. There is no reason to believe that the reaction of these subjects would be materially different from that of a group of similar size selected at random from the population.

#### RESULTS.

This experiment included the study of the effects of smoking both types of cigarettes on 31 subjects and involved the recording of 744 readings. The averages of the readings for each subject are given in Table 1 (Subjects 7 and 25 did not return for the second test and are omitted from the tables).

There are several ways of analyzing the data and evaluating the reactions. Kopetzky calculated the ratios of the post-smoke readings to the presmoke readings and compared these ratios for the two types of cigarettes in order to evaluate the relative effects of these cigarettes.

In order to compare our results with those of Kopetzky, his method of analysis was employed, using the first presmoke reading immediately preceding smoking and the first post-smoke reading to calculate the ratios since he used only one reading at each time. These ratios are given in Table 1 in the columns headed "c/b." In the group of subjects there were

TABLE 1. AVERAGES OF FOUR COLORIMETRIC READINGS.

No.	Diethylene Glycol (Car)			Glycerine (Tin)		
	a	b	c	a	b	c
1	51.50	60.75	20.25	34.25	44.50	38.00
2	33.25	38.50	39.50	34.75	28.75	35.25
3	30.25	44.25	47.00	51.25	40.25	71.50
4	42.25	30.25	46.75	28.25	18.50	31.00
5	38.50	33.25	32.00	26.75	32.00	26.25
6	61.00	53.75	57.00	52.50	53.75	59.50
8	30.00	34.50	36.25	31.75	28.00	35.75
9	42.25	49.75	52.00	47.75	32.00	35.25
10	29.00	30.50	33.00	30.00	27.25	35.25
11	52.25	49.00	61.75	32.75	43.75	41.00
12	38.00	34.75	36.75	30.25	32.00	33.00
13	34.50	33.75	29.50	49.00	51.25	50.50
14	18.50	18.25	23.75	24.25	21.00	23.00
15	36.50	33.50	34.25	32.50	33.00	32.75
16	53.25	55.75	51.25	48.50	47.25	44.75
17	44.00	35.00	36.75	43.25	42.00	42.50
18	40.00	44.00	43.75	33.00	27.75	27.25
19	15.25	23.50	19.50	34.25	30.00	33.00
20	34.25	37.00	34.00	24.50	27.00	30.00
21	18.75	18.25	19.25	27.75	26.75	31.00
22	23.50	27.25	28.25	17.75	18.00	18.50
23	23.50	22.25	20.75	29.50	30.75	28.25
24	34.25	37.50	37.25	26.00	25.75	27.00
26	46.25	45.25	46.50	37.75	37.00	37.00
27	34.00	27.25	36.50	34.75	37.75	35.75
28	38.75	38.00	37.75	49.75	39.75	40.00
29	50.50	51.75	53.00	49.50	53.50	49.00
30	44.50	54.75	49.75	32.25	38.75	39.50
31	32.75	35.00	36.00	32.00	32.50	26.25
32	33.75	28.25	29.00	37.00	30.75	32.25
33	42.00	43.00	41.00	41.00	40.75	35.25
Av.	37.000	37.694	37.741	35.629	34.581	36.298

17 for whom the ratio for the diethylene glycol treated cigarettes was less than the ratio for the same subject with glycerine treated cigarettes and there are 14 subjects for whom the reverse is true. Employing the method of summarizing used by Kopetzky the conclusion would be that the throats of 55 per cent of the subjects became "redder" after smoking diethylene glycol treated cigarettes. This interpretation of the data is open to question, but before discussing this point it would be well to follow the same methods in analyzing all of the readings for each subject instead of only the first readings. To do this the average readings for the two pre-smoking series were compared with the average postsmoke readings for each subject. These ratios are given in Table 2

in the columns headed " $\frac{c}{(a+b)/2}$ ". When the two ratios for each subject are compared as above, it is found that there are now 19 subjects for whom the ratios for the diethylene glycol

TABLE 2. RATIOS OF COLORIMETER READINGS.

Ratio of Single Readings		Ratio of Averages		"Redder"			
c/b		$\frac{c}{\frac{a+b}{2}}$		c/b		$\frac{c}{\frac{a+b}{2}}$	
DEG	G	DEG	G	DEG	G	DEG	G
1	0.254	0.872	0.361	0.965	x	x	
2	0.857	0.975	1.101	1.110	x	x	
3	1.035	2.570	1.262	1.562	x	x	
4	1.400	2.000	1.290	1.326	x	x	
5	1.105	1.071	0.892	0.893		x	
6	0.980	1.206	0.993	1.120	x	x	
8	1.114	1.578	1.124	1.196	x	x	
9	1.104	1.000	1.130	0.884		x	x
10	1.032	1.111	1.109	1.231	x	x	
11	1.181	0.937	1.220	1.071		x	x
12	1.056	0.971	1.010	1.060		x	
13	0.648	0.941	0.864	1.007	x	x	
14	1.263	1.000	1.293	1.016		x	x
15	1.233	0.912	0.978	1.000		x	
16	0.842	1.000	0.940	0.934	x		x
17	0.973	1.119	0.930	0.997	x	x	
18	1.022	0.929	1.042	0.897		x	x
19	0.870	1.133	1.006	1.027	x	x	
20	0.946	1.154	0.954	1.165	x	x	
21	1.052	1.032	1.040	1.137		x	
22	1.209	1.058	1.113	1.034		x	x
23	0.913	1.037	0.907	0.937	x	x	
24	0.921	0.926	1.038	1.043	x	x	
26	1.042	1.000	1.016	0.989		x	x
27	1.333	1.000	1.192	0.986		x	x
28	0.975	1.097	0.984	0.893	x	x	
29	0.981	0.887	1.037	0.951		x	x
30	1.083	1.326	1.002	1.112	x	x	
31	1.193	0.647	1.063	0.814		x	x
32	0.900	1.059	0.935	0.952	x	x	
33	0.936	0.857	0.965	0.862		x	x
Av.	1.015	1.110	1.025	1.038			
No. R	14	11	12	14	17	14	12

Key: DEG ratio greater than glycerine ratio; DEG less reddening than glycerine.

DEG ratio less than glycerine ratio; DEG more reddening than glycerine.

treated cigarettes were less than for glycerine treated cigarettes, and 12 subjects in the opposite category. It would be concluded from this that the throats of 61 per cent of the subjects became "redder" after smoking diethylene glycol treated

cigarettes instead of the 55 per cent calculated above. The Chi square test shows that neither percentage is significantly different from 50 per cent. The major fallacy in this method of analysis lies in the fact that the ratios for a substantial number of the subjects are greater than 1.0, indicating that the reflectance of the pharynx increased after smoking. This increase is probably attributable to blanching of the tissue and will be discussed at greater length later in this report. At this point, however, the propriety of comparing two ratios, both of which indicate blanching, and concluding that the cigarette producing the lesser blanching produces the greater reddening is questioned. For this reason the comparison of ratios for the individual subjects does not appear to be a valid method of analysis.

In order to circumvent this difficulty another method of analyzing the ratios is to count the numbers of subjects exhibiting ratios of less than one, *i.e.*, subjects whose pharynx became "redder" or showed a decreased reflectance. Following this method it was found that 12 subjects showed average ratios of less than one following the smoking of diethylene glycol treated cigarettes, and 14 showed an average ratio of less than one following the smoking of glycerine treated cigarettes. When the ratios of single readings (Columns c/b, Table 2) are counted in this manner it is found that there are 14 in the diethylene glycol column, and 11 in the glycerine column. The Chi square test shows that neither difference is significant.

A third method of analyzing the ratios is to calculate the average ratio for all of the subjects for the two types of cigarettes. The results of this calculation show that the average ratio (using all the readings) for diethylene glycol treated cigarettes is 1.025 and that for glycerine treated cigarettes is 1.038, which is not a significant difference. The conclusion to be drawn is that while some of the subjects showed a decreased reflectance following smoking, others showed an increased reflectance and that the average reaction was an increased reflectance for the group. This increase was slightly less, although probably not significantly so, for the diethy-

lene glycol treated cigarettes than for the glycerine treated cigarettes. From these analyses of the ratios it appears, therefore, that there was no difference in the effects observed between the two types of cigarettes.

The analysis of the ratios of the readings is open to some criticism because the ratios so calculated are somewhat biased in that with low readings a given numerical change results in a greater change in the ratio than a similar numerical change with high readings. For example, readings of 20 and 18 give a ratio of 0.90, whereas readings of 62 and 60 give a ratio of 0.97. Consequently, we believe that the analysis of the actual differences observed gives a truer picture of the effects observed. The numerical differences between the individual readings on each subject were computed and their averages are given in Table 3.

The differences involved in the presmoke period were calculated by subtracting the first presmoke reading from the corresponding presmoke reading taken 15 minutes later. This calculation was made for all of the readings on each subject. The average difference for all of the subjects was 3.097 for the readings prior to smoking the diethylene glycol treated cigarettes and -4.258 for all of the readings prior to smoking glycerine treated cigarettes. This difference of more than seven points between the two means is obviously due to the uncontrolled factors of the readings since the two means should be identical.

TABLE 3. DIFFERENCES BETWEEN CORRESPONDING READINGS ON EACH SUBJECT.

	Average Differences	
	Presmoke (b-a)	Postsmoke (2c-b-a)/2
Diethylene glycol .....	3.097	1.484
Glycerine .....	-4.258	4.678
Difference .....	7.355	-3.194

The differences resulting from the readings obtained after smoking were calculated by subtracting the sum of the two presmoke readings from twice the corresponding postsmoke reading. The average difference calculated in this manner for the readings following the smoking of diethylene glycol

treated cigarettes was 2.968 and the average difference following the smoking of glycerine treated cigarettes was 9.355. (In Table 3 these are divided by two for comparison with the presmoke difference.) Thus in both instances the average readings following smoking were larger than the presmoke readings. This again indicates that the overall effect of smoking both types of cigarettes was that of increasing the reflectance, which in turn may be attributable to blanching of the tissue. In view of the comparatively large disparity (seven points) between the differences for the presmoke readings and also for the two series of postsmoke readings (six points), it is desirable to examine the data somewhat more critically than was done above in analyzing the ratios. In order to do this an analysis of variance\* was made on all of the data.

Before proceeding with the discussion of the results of this analysis, however, it should be pointed out that there are numerous variables in experimental data of this sort which should be controlled and which were ignored in the above analysis of ratios. These variables are: 1. the differences in readings on the same subject during the 10 second intervals; 2. the variability of the reaction of the different subjects; 3. the variability of the individual subjects from day to day; and 4. the spontaneous changes in the subject which were

TABLE 4. COLORIMETER READINGS ON COLORED BLOCKS.  
CROSS POLAROIDS

Red	(a) Dry			(c) Wet		
	1	2	Average	1	2	Average
1A	46.3	46.5	46.4	75.7	81.4	78.6
2A	74.6	74.6	74.6	91.0	94.0	92.5
3A	100.0	100.0	100.0	(1)100.0	100.0	100.0
4A	115.9	114.7	115.3	121.0	122.2	121.6
5A	147.0	147.0	147.0	160.0	158.0	159.0
White	423.0	418.0	420.5	380.0	371.0	375.5
Blue						
A	243.0	240.0	241.5	236.0	223.0	224.5
B	243.0	242.0	242.5	232.0	227.0	229.5
C	180.0	178.0	179.0	178.0	176.0	177.0
D	167.0	166.0	166.5	176.0	175.0	175.5

(1) reading is  $3.0/2.6 \times$  dry reading.

\*The method of analysis was suggested to us by Prof. George W. Snedecor.



## WITHOUT POLAROID

Red	(b) Dry			(d) Wet		
	1	2	Average	1	2	Average
1A	45.1	45.3	45.2	121.5	120.5	121.0
2A	67.3	67.5	67.4	107.7	107.3	107.5
3A	(2)100.0	100.0	100.0	(3)100.0	100.0	100.0
4A	60.9	60.3	60.6	102.0	103.1	102.6
5A	49.5	49.4	49.4	117.4	117.9	117.6
White	108.7	109.2	109.0	>130.0	>130.0	>130.0
Blue						
A	86.7	86.9	86.8	105.5	116.0	110.8
B	102.7	102.8	102.8	121.2	124.0	122.6
C	75.0	75.8	75.4	103.7	106.0	104.8
D	46.7	46.3	46.5	114.1	117.8	116.0

(2) Crossed Polaroid value is 2.6 per cent of this value.

(3) Crossed Polaroid wet value is 1.6 per cent of this value.

NOTES: In the red series 1A is the deepest red and 5A is the lightest. In the blue series A and B are duplicates. C and D are darker blue than A and B and differ from each other in that C has a semigloss finish while D was rubbed to a matte finish.

measured during the 15 minute presmoke period which is the principal factor in the "experimental error" of the procedure. It was possible to compensate for these variables by employing the methods of the "analysis of variance" and as a result of these analyses to show that:

1. Smoking results in changes in the reflectance of the pharynx.

2. Individual subjects differ from each other in their reaction to smoking as measured by the reflectance of the pharynx to such an extent as to indicate the presence of more than one factor influencing the reflectance of the pharynx.

3. The differences in reflectance of the pharynx observed as between the two types of cigarettes used were not significant.

In view of the fact that the statistical analysis indicated that the reaction of the subjects to smoking was different for different individuals, the smoking habits of these subjects as reported by them in terms of the average number of cigarettes smoked per day were compared with the combined changes resulting from smoking the two types of cigarettes. A correlation analysis was made on these data and the correlation coefficient,  $r$ , was found to be 0.128, which is some-

what less than required for significant correlation. It, therefore, appears that the differences in individual reaction are the result of the idiosyncrasies of the subject or the presence of more than one agent affecting the reflectance of the pharynx rather than his normal smoking habits.

#### DISCUSSION.

The results reported in the preceding section indicated that no appreciable differences in effects on the appearance of the pharynx to the photo tube occurred as a result of smoking the two types of cigarettes under consideration; however, while the effects between the two cigarettes did not differ, there was a definite effect as a result of smoking. On the average this was an increase in the reflectance of the pharynx. As mentioned above, Kopetzky interpreted this to mean that the pharynx was whiter or less red. On the basis of work with color standards of differing degrees of redness, this assumption is perhaps justified under certain conditions. The photo tube used is practically insensitive to red and since the light reflected from a colored surface consists primarily of the color of that surface with most of the other colors absorbed, an increased saturation of red would result in a lower reflectance as recorded on the meter; however, this relationship holds true only if diffuse reflection is under consideration. Specular or mirror-like reflection is much more complicated and the reflected light is likely to resemble the incident light to a greater extent than is the case with diffuse reflection. Since wet surfaces exhibit specular reflection, as is commonly observed when light shines on a wet street, the question naturally arises as to whether or not this type of reflection is likely to interfere with the measurement of color of the pharynx. In photographing numerous throats we have observed that highlights resulting from specular reflection are very common and while the entire surface of the pharynx may not be obliterated by these highlights, it is obvious that the appearance of only one may materially affect the readings of the photo tube.

In an attempt to minimize this effect of specular reflection,

a polarizing filter was installed between the lens and the lamp bulb and a second one at right angles to the first in the filter holder in front of the photo tube. The result of this was to reduce the intensity of the light reaching the photo tube, but also it substantially reduced the specular reflection or glare. For example, when a reading was attempted on the color standard without a polarizing filter, the reflectance was much more than 1,300, and beyond the range of the meter; furthermore, when the photo tube was removed and we looked through the collimating tube at the standard, it was found to resemble a mirror. No color other than that of the light itself could be discerned in the illuminated area—thus indicating a high degree of specular reflection. When, however, the polarizing filters were in place, the true color of the standard could be observed and readings were possible with the photo tube. That these filters did not completely eliminate the specular reflection or glare is indicated by the following experiment in which the color standard was moistened with saliva: A drop of saliva was placed on the color standard and as a result the reading increased from 100 to 109. That the reading is also affected by the amount of moisture is shown by the fact that if instead of a drop of saliva the entire surface of the color standard is coated with saliva the reading is increased to 130.

The pharynx in normal individuals is always coated with a layer of mucus and saliva. This layer is transparent and differs from the appearance of mucopus which is usually opaque white or yellow. Mucopus is, of course, not normal and when observed the subjects were asked to clear their throats. That the other changes in the normal layer of mucus resulted in differences in reflectance which were insignificant during the presmoking period was shown by the above analysis of the presmoke data; however, it was noted by us that salivation and secretion of mucus were stimulated by smoking with many smokers and while we have no proof, it appears likely that smoking may inhibit these secretions with other smokers. In view of this phenomenon and the fact that the above experiment with the color standard has shown that the read-

ings are influenced by major changes in the moisture film, it does not seem possible to state unequivocally that the observed changes in the reflectance were due to changes in color.

On the basis of the experiments performed on the limitations of the instrument (see Table 4) it appears that while the readings on color standards are changed by the presence of a moisture film, they are not changed appreciably by minor changes in the thickness of this film and that if polarizing filters are used the instrument can measure color changes even when a layer of moisture is present; however, without the filters the readings are wholly unreliable. Consequently, while the probability is that the readings on the subjects are measures of color, this fact is not known with certainty since there may be some difference between taking readings on the throat and on colored blocks.

If it is assumed that the changes in reflectance observed are the result of actual changes in color and not of changes in the film of moisture, it may be concluded that the average reaction of the group of subjects was that of blanching following the smoking of both types of cigarettes. This blanching could be an indication of vasoconstriction and may be attributable to the effects of nicotine which is generally recognized to have this action. The effects of nicotine on the peripheral vascular system have been verified and summarized recently by Roth, McDonald and Sheard.<sup>6</sup> Since the average changes were toward blanching, it seems that the predominating effect is that attributable to nicotine and that any irritating effects attributable to smoke must have been masked by the vasoconstriction of the blood vessels in the postpharyngeal wall. It appears, therefore, that it is useless to attempt to compare irritating properties by a method such as that used here and that if irritation occurs, evidence of it could be observed only when the superficial blood vessels are not constricted as a result of the action of nicotine.

#### CONCLUSIONS.

A series of 744 readings on 31 subjects was made employing a photo tube with polarizing filters to measure the changes

in reflectance of the pharynx following the smoking of glycerine treated cigarettes and diethylene glycol treated cigarettes. The results of these readings were as follows:

1. No significant difference was found between the changes in reflectance resulting from the smoking of the two types of cigarettes.

2. The smoking of both types of cigarettes resulted in a slightly increased reflectance which is probably attributable to blanching of the tissue, but may be due to changes in the film of mucus on it.

3. No correlation was found between the number of cigarettes normally smoked per day by the subjects and the changes in reflectance observed in this test; however, the reaction of the subjects to smoking differed substantially from one individual to another.

4. The correlation between the reflectance readings and changes of color of the pharynx is discussed and it is concluded that the changes in reflectance probably are the result of changes in color, but that the evidence is insufficient to justify a more positive statement due to the possible complications introduced by unknown changes in the film of mucus on the pharynx; however, if the measurements represent color, the average effect observed was that of blanching rather than reddening.

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The data contained in this paper have been used in Federal Trade Commission hearings, Docket No. 4794.

The expense of this investigation was borne by the Association of American Soap and Glycerine Producers, Inc.

## THE TREND OF TREATMENT OF BRONCHIECTASIS DURING THE PAST TWO DECADES.\*

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The treatment of bronchiectasis represents one of the most significant phases in the evolution of modern medicine and surgery. Although the condition was recognized and described by Laennec as early as 1819, little contribution was made to clear the perplexity of the disease and pave the way to effective treatment for almost a century later. In direct contrast to this long period of uncertain knowledge and mystifying beliefs, the past two decades represent a period of remarkable progress in the treatment of this disease, which is undoubtedly due to the "unified interest and aggregated and assiduous endeavors of specialists in their respective fields of physiology, radiology, bronchoscopy, anesthesia and thoracic surgery."<sup>1</sup>

It is our purpose in this review to present an integrated account of the trends in the treatment of bronchiectasis, especially within the past two decades, and to stress particularly the prophylactic measures in its management.

In order to appreciate the strides made in the progress of the treatment of bronchiectasis, certain facts must be known concerning the etiology, pathogenesis and pathologic features of the disease. The etiology and pathogenesis of bronchiectasis are not too clearly understood. Various writers have offered congenital predisposition, climatic changes, cirrhosis of the lung, allergy, chronic sinusitis and bronchitis, acute infectious diseases, impaired nerve and muscular control, bronchial obstruction produced by tuberculous stenosis, neoplasms and foreign bodies as causes. It is doubtful if some of these causes set forth are more than contributory, as in the

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Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Nov. 29, 1946.

instance of climatic conditions. The belief that chronic sinusitis precedes bronchiectasis and is a common cause has been discredited in recent years by studies that indicate that bronchiectasis is not always associated with disease of the paranasal sinuses and frequently precedes it. Riggins<sup>2</sup> has shown that in 100 cases of bronchiectasis, only 30 per cent had associated chronic sinus infection, and that two-thirds of these had evidence of bronchiectasis from several months to several years before the onset of chronic sinus infection. Bronchial obstruction is now generally admitted as one of the most significant etiologic factors in bronchiectasis. Mechanical factors such as foreign bodies, extrabronchial and intrabronchial tumors, inflammatory bronchial stenosis associated with upper respiratory infections, as well as strictures following tuberculous infections are all good examples.

Of greatest therapeutic significance is the pathologic process in bronchiectasis. Riggins<sup>2</sup> states that the early pathologic changes which eventually lead to demonstrable dilatation of the bronchi are not confined to the bronchial wall but to the lung parenchyma. These changes very frequently develop following pneumonia in early childhood. It is to be noted that many of these inflammatory changes fail to undergo complete healing and many areas progress to a state of "irreversible fibrosis."<sup>2</sup> If the infection becomes chronic or recurrent in nature, further fibrosis with shrinkage of the involved lobe occurs. These same changes occur to a similar degree within the bronchial wall. The mucosal alterations are variable, consisting of ulceration, chronically infected granulation tissue, with the eventual loss of the normal elastic and muscular structures which are replaced by fibrosis. As an end-result of these infectious processes, weakening of the bronchial wall occurs and frequently coughing acts as a sufficient dilating force to cause ectasia of the bronchus. It has also been pointed out by Riggins<sup>2</sup> that stenosis may occur at the stem, resulting in a weakened wall distally, leading to dilatation and pooling of virulent and often anerobically infected secretions. Hennell<sup>20</sup> believes that the trauma produced by respiration because of lowered intrapleural pres-



sure, resulting from atelectasis or fibrosis of the pulmonary parenchyma, is to be considered an aggravating factor in the production of bronchial ectasia. In brief, the end-result of the underlying pathologic processes in bronchiectasis is a destructive one in which "the normal bronchial architecture is replaced by a less specialized tissue,"<sup>3</sup> the ciliated columnar epithelium is replaced by nonciliated cuboidal or squamous epithelium, and the normal elastic and muscular tissue by fibrosis. It was not until this fact became fully realized that light was thrown in the direction of surgery as a cure for this "hopeless" condition. Ochsner and DeBakey<sup>1</sup> have emphasized this very fact by stating that "no method of therapy will restore normal bronchial and parenchymatous structures which have been replaced by fibrous tissue."

No doubt one of the greatest factors which impeded effective treatment of bronchiectasis was the fact that until 1922, when Sicard and Forestier introduced lipiodol bronchography, an accurate diagnosis could not be made.<sup>4</sup> Prior to 1922, the diagnosis of bronchiectasis was made on the basis of signs and symptoms of the disease and, occasionally, from the findings on the Roentgen plate. Undoubtedly the diagnosis was missed in many instances and frequently confused with tuberculosis or pneumonia in others, and occasionally, if not too often, "entirely overlooked." Today, it is believed that the diagnosis of bronchiectasis is not difficult if the condition is kept in mind.

Good<sup>5</sup> states that bronchiectasis should be suspected where there is X-ray evidence of a slowly resolving or recurrent bronchopneumonia in the base of one or both lungs, or whenever there is an atelectasis of a lobe or portion of a lobe (especially in children), and whenever the pulmonary markings in the bases of the lungs are prominent or honeycombed in effect.

Certainly such findings warrant further investigation by bronchographic means, which, in brief, is the only method of making an accurate diagnosis.

In the light of understanding of the pathologic anatomy of

bronchiectasis, it is easy to see why conservative or medical treatment has failed. At best, medical treatment can only be palliative. Hinshaw<sup>6</sup> states that conservative or medical treatment of bronchiectasis has never been effective and that "less than 10 per cent of patients have gratifying results."

Postural drainage is perhaps one of the oldest and most beneficial measures used in conservative treatment. For effective postural drainage, Hinshaw<sup>6</sup> recommends that the hips be elevated, shoulders lowered, with the thorax as nearly inverted as possible, having the patient cough as much as possible in this position. This procedure should be used before each meal and at bedtime. Other conservative measures which have been recommended are changes in climates to those which are warm with dry atmosphere, improvement in nutrition, the use of autogenous vaccines, ultraviolet, high voltage Roentgen irradiation and the use of certain drugs. Iodides have been of some value in avoiding stagnation of thick, purulent secretions. Since the first introduction of iodized oil into the tracheobronchial tree by Sicard and Forestier in 1922, it was used therapeutically after it was observed that many patients were improved clinically following its use for diagnostic means. There has been considerable question as to the manner in which the oil exerts a beneficial effect in bronchiectasis. Ochsner<sup>7</sup> reported the results of 1,500 bronchographies in 1930 and found that 32 per cent of the number showed radiographic evidence of cure. Thirty-six per cent obtained symptomatic relief but after an acute respiratory infection had a temporary relapse. Thirty-two per cent were improved and still under observation at the time of his report. He found a progressive diminution in the number of organisms contained in the sputum of those treated, which paralleled the patient's clinical improvement. Some reporters believe that the oil exerts a bactericidal effect, while others contend that its effect is entirely through displacement of secretions. Aside from evidence of iodism in very few cases reported in the literature, it is doubtful if the use of iodized oil has produced any major harmful effects. It has not been shown whether the dilated bronchi and cavities become filled with granulation tissue and later fibrose.

Chemotherapy and allergy management have been given a fair trial and perhaps the best evidence of the effectiveness is reported by Thomas, Van Ordstrand and Tomlinson,<sup>8</sup> who have shown that in a series of 190 cases of bronchiectasis, nearly one-half had major allergy of the respiratory tract. A clinical study was made of 75 selected cases to evaluate sulfonamide therapy and management in the treatment. It was found that in 55 of these cases an allergy of the respiratory tract was an etiologic or complicating factor. Twenty-three cases received sulfonamide drugs as the chief or only therapeutic measure and were observed over a period of from four months to four years. Twenty-two of these patients showed definite improvement, with reduction of cough and sputum. Combined allergy and sulfonamide therapy was used in 31 cases and it was shown that 26 of these patients had improvement of 25 to 100 per cent in cough and expectoration.

Bobrowitz, Edlin, Bassin and Woolley<sup>9</sup> have reported their results in the treatment of 12 cases of severe bronchiectasis with penicillin. The drug was administered by intramuscular, intratracheal injection and inhalation, or by a combination of these methods. The total dosage varied from 550,000 units to 5,500,000 units and the length of treatment extended from four to 115 days. The concentration of penicillin in the sputum was found to be highest by intratracheal administration, less with inhalation, and lowest with intramuscular injection. The most rapid results were obtained by intratracheal injection, which showed the volume of sputum diminished. The odor and most of the organisms were removed, and the purulency reduced. Considerable symptomatic relief was afforded those patients. Improvement was maintained so long as the penicillin was continued, but did not persist when it was discontinued.

In a report of 21 cases treated with penicillin who received an average of 1,000,000 units given in divided doses intramuscularly and in some cases by intravenous drip, Stookey and others<sup>10</sup> noted that the only significant change detected from the standpoint of bacteriology was a decrease in the number of colonies of hemolytic streptococci and staphylo-

cocci, and a slight reduction in the number of colonies of non-hemolytic organisms. Their treatment extended over a period of eight to 10 days, and from a clinical standpoint all showed evidence of improvement. It is interesting to note that the volume of sputum was found to be unchanged.

The results of an exploratory study of the effectiveness of penicillin aerosol therapy in 20 patients with bronchopulmonary infection reported by Barach, Silberstein, Oppenheimer, Hunter and Saraka<sup>11</sup> revealed that the predominating organisms in the sputum cultures were consistently absent 24 hours after the discontinuance of the treatment. The blood level of penicillin for one hour following inhalations of the aerosol was generally between 0.01 and 0.04 units, and at times as high as 0.18 units. The writers have pointed out that the aim of the treatment is generally not high blood levels, but that of local application of penicillin to the bronchial wall. They concluded that further studies were indicated in the treatment of bronchiectasis with penicillin aerosol.

Kay and Meade<sup>3</sup> believe that penicillin is of no permanent value in the treatment of bronchiectasis. They found it to be of value in repeated pneumonic episodes, as well as in decreasing sepsis and toxicity, but as soon as the drug was discontinued the symptoms recurred. The hope that penicillin would bring about a cure in bronchiectasis seems to hinge on the theory that the secretion of the bronchial mucosa is due to invasion of the mucosa by pathogenic cocci, and if this were so, penicillin should exert an inhibiting influence upon the disease. In the opinion and judgment of Barach, Silberstein, Oppenheimer, Hunter and Saraka,<sup>11</sup> "the profuse secretion of low specific gravity from the bronchioles was not due to bacterial action but to structural changes within the endothelium of the smaller bronchioles." They believe, as others, that the true bronchiectatic shows little or no response to the administration of penicillin.

From the foregoing remarks, it is apparent that the medical treatment of bronchiectasis may be dismissed, since it cannot cure the disease, especially when one realizes the irre-

versible pathologic state of the disease. The mortality of medically treated cases of bronchiectasis is exceedingly high. Perry and King<sup>21</sup> have shown that the mortality of nonsurgically treated patients was 26 per cent in their group of 400 patients studied over a 12-year period. Seventy-eight per cent of those deaths were due to the disease itself. Some statistics bear out the repeated expression that "those who develop bronchiectasis before 10 will not live beyond 40."<sup>22</sup>

Bronchiectasis is now recognized as a surgical disease. It is interesting in retrospect that inasmuch as bronchiectasis had been treated ineffectively for many years, surgeons tried to develop a successful procedure. As early as 1873, Mosler<sup>12</sup> suggested that bronchiectatic cavities be opened and drained. Bronchotomy, however, was soon abandoned as a surgical procedure, due to the consistently high mortality rate. Pathologic studies soon showed the impossibility of adequately draining multiple bronchial cavities by a single incision.

In 1901, Heidenhain<sup>13</sup> performed a lobectomy for bronchiectasis, but it was not until 1922, when radio-opaque oil was used for diagnosis, that progress in this type of surgery got its start. Pneumonectomy was tried quite early as a surgical procedure, but because the mortality in the procedure was approximately 35 per cent, ligation of the pulmonary artery was the next adopted procedure in an attempt to produce fibrosis of the involved portion of lung. The next surgical procedures were some form of collapse; artificial pneumothorax, thoracoplasty and evulsion of the phrenic nerve. Collapse therapy failed in the treatment of bronchiectasis because it was found almost impossible to compress dilated bronchi, and some writers believed that the treatment would be of no value even though it were possible to compress the bronchi, because the epithelial surfaces would never heal, no matter how long they were in contact. Nelson<sup>14</sup> points out that the treatment is not only valueless but that it diminished the chance for a successful lobectomy, should it become necessary later. It is his belief that it is necessary in the first-stage lobectomy to obtain early expansion of the remaining lobe in order to obliterate the pleural space before infection sets in. Recent studies by Hennell<sup>23</sup>

indicate that pneumothorax has some value in the treatment of early bronchiectasis. He believes that pneumothorax should be considered first in the treatment of early cases and in a report of six cases has shown the following accomplishments by this method:

1. Pneumothorax decreases trauma of a weakened bronchus due to respiration.
2. It decreases or eliminates trauma due to cough.
3. It counteracts the increased pull on diseased bronchi because of lowered intrapleural pressure incidental to atelectasis or fibrosis of the pulmonary parenchyma.
4. It eliminates infection of the bronchi or lung.

Unfortunately, it appears that too many cases of bronchiectasis do not fall within the group that are amenable to this form of therapy.

Oakley<sup>15</sup> found phrenic evulsion to be of some value symptomatically only in strictly basal and unilateral bronchiectasis and that it had some temporary value in the control of hemoptysis.

The only logical method of therapy in bronchiectasis is surgical extirpation of the diseased lung. Resection of the involved portion of lung has evolved for the most part within the last decade. It is the result of untiring study of surgical procedures, anesthesia, shock therapy, respiratory physiology, pathology, bronchoscopy and X-ray.

The modern single-stage lobectomy was first performed by Brunn,<sup>16</sup> in 1929, who reported six operations with four cures, one unimproved and one death. Shenstone and Janes,<sup>17</sup> of Toronto, improved on the method of Brunn by use of the tourniquet. In 1923, Graham<sup>18</sup> in a review of literature reported 48 cases of lobectomy for bronchiectasis with an operative mortality of 52 per cent. Because of the hazards of lobectomy, he devised cautery pneumonectomy and, in 1925, reported 20 cases with an operative mortality of 20 per cent.<sup>19</sup> Again, in 1935, Graham<sup>20</sup> and his associates reported from

the literature 212 cases of bronchiectasis in which lobectomy was performed. The surgical mortality was 34 per cent. The rest of whom survived, only 47 per cent had satisfactory results. Since 1929, almost incredible results have been obtained.

In 1940, Perry and King<sup>21</sup> made a report of 400 cases of bronchiectasis admitted to the Massachusetts General Hospital from 1926 to 1938. One hundred forty of these cases were treated surgically, and of this group that underwent lobectomy, a mortality of 3 per cent was reported.

Granted that bronchiectasis is a surgical disease, certain factors must be observed in the selection of patients for lobectomy. Unfortunately, not every case of bronchiectasis is a good risk for operation. Claggett<sup>4</sup> states that any patient between the ages of four and forty, and occasionally older, who has a reasonably well localized bronchiectasis with associated infection should be considered a candidate, providing no serious contraindication exists. Children's ability to withstand thoracic surgery is exceptionally good, and while the patient is still growing, true hyperplasia of the pulmonary tissue will develop to restore the function of the removed segment of lung, whereas in an adult compensatory dilatation of the alveoli with emphysema may occur.

The disease should be in the remission stage before operation is attempted and should not be performed before 10 days after lipiodol injection. Operation should not be undertaken on febrile patients who are in the acute or subacute pneumonic stage — a complication of bronchiectasis. Febrile patients with copious sputum should not undergo immediate operation due to the danger of infecting the pleura, mediastinum or chest wall with virulent anaerobic bacteria.

In discussing the surgical indications for bronchiectasis, Strieder<sup>22</sup> considers those cases where the diseased process is localized to one lobe or segment of the lung ideal for operation, consisting of segmental pneumonectomy or partial lobectomy. He points out that the mortality of this type of case



is less than 3 per cent and that the chances for complete cure are almost 100 per cent.

In unilateral disease where the right middle, and lower lobe or left lower and lingula of the left upper lobe is involved, double lobectomy and lingulectomy may be undertaken with little more risk than single lobectomy. If all lobes of a lung are involved, total pneumonectomy may be performed with a "respectable risk, certainly less than 10 per cent and probably less than 5 per cent."<sup>22</sup>

In bilateral disease, bilateral lobectomy in stages is frequently performed. Cases where both lower lobes, right middle and left lower lobes, right lower and lingula of the left upper lobe, or right lower and middle and left lower lobe have been involved, have successfully undergone lobectomy in staged operations according to Strieder;<sup>22</sup> furthermore, he states that even in four-lobe disease, such as right middle and right lower and left lower and lingula of left upper lobe, patients have occasionally been treated by excision of the diseased portions.

No attempt has been made in this review to discuss any of the surgical techniques in the treatment of bronchiectasis, but mass ligation with a tourniquet and individual isolation and ligation of the intralobar structures are the two most commonly employed methods. Carlton and Adams<sup>23</sup> believe that important factors in the progress of postoperative patients are rapid expansion of the remaining lung, replacement of blood loss and avoidance of anoxemia and serious infection following operation. Bronchoscopic aspirations at weekly intervals prior to operation, postural drainage and penicillin therapy are great adjuncts in the prevention of postoperative complications.

#### PROPHYLACTIC TREATMENT.

Jackson<sup>24</sup> has made the statement that "it is safe to say that the incidence of bronchiectasis could be reduced to relative rarity if every patient with tardy recovery from acute infection of the lower respiratory tract were promptly given

the benefit of bronchoscopic aspiration." Bronchial obstruction and infection are admittedly the chief primary causes of bronchiectasis. According to Clerf,<sup>25</sup> the degree and duration of obstruction and the severity of infection are the most important factors which influence the speed of development and extent of bronchopulmonary pathology. It becomes apparent, then, that it is of utmost importance to recognize bronchial obstruction with the changes it brings about, and to differentiate them from pneumonia, unresolved pneumonia or empyema.<sup>24</sup>

Too much emphasis cannot be placed on the responsibility which the pediatrician or general practitioner assumes in the management of childhood diseases, especially in respiratory infections where streptococcal and influenzal pneumonias are encountered. When pneumonia fails to subside, X-ray and bronchoscopy are definitely indicated. A search for inflammatory stenoses, thick secretions should be thoroughly made, and proper treatment instituted. Bronchoscopy has its greatest value in the recognition of bronchiectasis and in the treatment of its complications (Olsen<sup>27</sup>). Foreign bodies, bronchial tumors, broncholiths and structures must be ruled out by bronchoscopic examination. Bronchoscopy is of unlimited value in the prevention of bronchiectasis arising from post-operative atelectasis.

Since the only means of prevention of bronchiectasis is the prevention of its causes—bronchial obstruction should always be kept in mind in the presence of any suggestive pulmonary infection. X-ray examination should be performed routinely in these cases, and if there is reason to believe that bronchial obstruction exists, bronchoscopy should not be delayed. Repeated bronchoscopic aspirations may be necessary where thick, tenacious secretions exist as localized obstructions. Jackson<sup>24</sup> has stressed the importance of a "conservative regimen" to build up reserve resistance in the presence of a pulmonary infection which tends to linger. In it, he enumerates physical rest, good ventilation, proper diet, high vitamin intake, chemotherapy, if indicated, and the elimination of all sedatives or antituberculous. There is abundant

clinical evidence to show that this is perhaps one of the most important considerations in the prevention of bronchiectasis.

#### SUMMARY.

1. The treatment of bronchiectasis in the past has been both medical and surgical. For many years, lack of knowledge as to the etiology and pathology of the disease was responsible for erroneous diagnoses which prevented proper institution of treatment.

2. Because medical treatment has been unsatisfactory and yielded so few results, present-day medical authorities now agree that bronchiectasis is a surgical disease and that the only permanent cure is excision of the diseased portion of lung.

3. Medical treatment in bronchiectasis is of palliative value in that group of patients in which surgery is contraindicated. It is definitely an adjunct to surgical treatment, in that many patients are rendered better risks, having been treated pre-operatively by postural drainage, penicillin, chemotherapy and bronchoscopic aspiration. Penicillin and chemotherapy have practically minimized postoperative complications following lobectomy, but are by no means a cure for the disease.

4. Modern surgery for bronchiectasis has developed for the most part within the last decade and carries a mortality rate of approximately 3 per cent in most clinics. One of the important objects in the treatment is early diagnosis, since it has been shown that best results in thoracic surgery are those in children.

5. Pediatricians and general practitioners who assume responsibility for the care of early childhood pulmonary infection can play a very important rôle in the prevention of bronchiectasis by being ever mindful of its two primary causes, *viz.*, bronchial obstruction and infection. When these conditions are suspected, there must be no delay in obtaining the assistance of the Roentgenologist and bronchoscopist for accurate diagnosis.

6. Bronchoscopy is of immeasurable value in the recognition and treatment of those many etiological factors previously mentioned, which would undoubtedly lead to the development of this disease.

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### THE LOUISIANA-MISSISSIPPI OPHTHALMOLOGICAL AND OTOLARYNGOLOGICAL SOCIETY.

The Louisiana-Mississippi Ophthalmological and Otolaryngological Society will hold its annual meeting at the Buena Vista Hotel, Biloxi, Miss., on May 5, 1947. The following program will be presented:

- 8:30 A.M. Registration.
- 9:30 A.M. Call to Order, President George Adkins.  
Introductions and Presentations.
- 9:30 A.M. The Rhinoplastic Operation and the Restoration of Nasal Function — Dr. Samuel Fomon, New York City, N. Y.  
Newer Trends in the Treatment of Ocular Diseases—Dr. Peter C. Kronfeld, Chicago, Ill.
- 12:30 P.M. Luncheon.  
Executive Session.
- 2:30 P.M. The J. Raymond Hume Memorial Address:  
Ménière's Disease — Dr. Henry L. Williams, Rochester, Minn.  
Allergic Problems Seen by the Ophthalmologist and Otolaryngologist—Dr. Ralph Bowen, Houston, Tex.  
Social Hour.

## AN INTRODUCER FOR TRACHEOSTOMY TUBES.\*

HAYES MARTIN, M.D.,

New York, N. Y.

This instrument was designed to facilitate the introduction of the breathing tube at the time of tracheostomy. It consists of a curved, bluntly pointed, hollow obturator whose tip has numerous perforations, so that when inserted through a slit in the trachea its presence within the tracheal lumen can immediately be detected by an exchange of air (see Fig. 1).



Fig. 1. Bluntly pointed, hollow obturator whose end has numerous perforations. Instrument threaded on a standard No. 6 life-saving tracheostomy tube.

The tracheostomy tube introducer resembles an emergency instrument, except that when inserted it carries with it the standard tracheostomy tube.

In difficult cases where the trachea cannot be visualized through the wound, and where its position must be determined by palpation alone, a slit in the trachea can be made, guided only by the palpating finger and the introducer inserted blindly and directed digitally. An exchange of air through

\*From the Head and Neck Service, Memorial Hospital, New York, N. Y. This instrument is manufactured by and may be purchased from the United Surgical Supplies Co., New York, N. Y.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Dec. 31, 1946.

the lumen is assurance that the tip of the introducer has entered the trachea. As soon as an exchange of air is noted, the instrument is fully introduced and when a continuance of air exchange has been established, the introducer is withdrawn, leaving the tracheostomy tube in place.

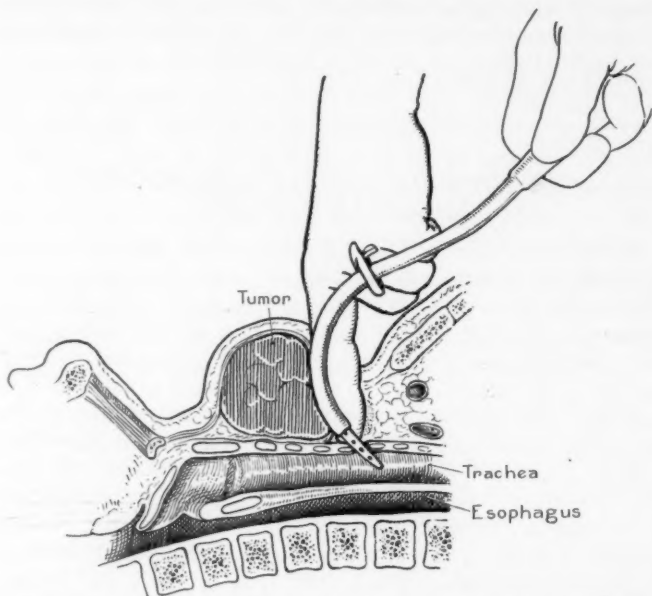


Fig. 2. Diagram of a sagittal section of a patient whose trachea has been displaced and overgrown by tumor.

In cases where actual exposure of the tracheal cartilages is difficult or impossible, the instrument may be inserted blindly and the opening in the trachea searched for until an exchange of air is noted through the hollow obturator. The instrument is then withdrawn, leaving the tracheostomy tube in place.

Although we consider the device indispensable in those cases where the trachea has been displaced or overgrown by tumor tissue, or where actual exposure of the tracheal cartilages is difficult or impossible, due to dense scarring of previous irradiation or surgery (see Fig. 2), the case with which a tube may be introduced into the incised trachea with this



technique even in uncomplicated elective cases has prompted us to include the instrument as part of all tracheostomy sets on the head and neck service at Memorial Hospital. For the performance of both elective and emergency tracheostomies, we have dispensed entirely with the olive-tipped bougie in favor of the introducer herein described. This olive-tipped bougie is later used, of course, for changing and replacing the tracheostomy tube when the tract has become well established.

737 Park Avenue.

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#### MISSISSIPPI VALLEY MEDICAL SOCIETY 1947 ESSAY CONTEST.

The Seventh Annual Essay Contest of the Mississippi Valley Medical Society will be held in 1947. The Society will offer a cash prize of \$100.00, a gold medal and a certificate of award for the best unpublished essay on any subject of general medical interest (including medical economics and education) and practical value to the general practitioner of medicine. Certificates of merit may also be granted to the physicians whose essays are rated second and third best. Contestants must be members of the American Medical Association who are residents of the United States. The winner will be invited to present his contribution before the Twelfth Annual Meeting of the Mississippi Valley Medical Society to be held at Burlington, Iowa, Oct. 1, 2, 3, 1947, the Society reserving the exclusive right to first publish the essay in its official publication—the *Mississippi Valley Medical Journal* (Incorporating the *Radiologic Review*). All contributions shall be typewritten in English in manuscript form, submitted in five copies, not to exceed 5,000 words, and must be received not later than May 1, 1947. The winning essays in the 1946 contest appear in the January, 1947, issue of the *Mississippi Valley Medical Journal* (Quincy, Ill.).

Further details may be secured from Harold Swanberg, M.D., Secretary, Mississippi Valley Medical Society, 209-224 W. C. U. Building, Quincy, Ill.

## A MODIFICATION OF THE NEGUS ESOPHAGOSCOPE.

JAMES MILTON ROBB, M.D.,

Detroit, Mich.

After having used several types of esophagoscopes in my practice, the conclusion was reached that a proximally lighted instrument would have distinct advantages over a distally lighted instrument if a lighting equipment could be developed that would carry and focus a good light at the end of the esophagoscope and for a short distance beyond.

To me, there is a distinct advantage in proximal lighting due to the fact that the lighting cannot be fouled by regurgitated stomach contents, for even when the patient has been properly prepared, there is bound to be some regurgitation.

The Negus instrument was well designed to be used as a basis for this experiment, lighted by means of side tubes, one on each side of the 18-inch main tube and so arranged that their axes converge at the distal end of the main tube.

It offered, too, another advantage in its utilization of increased width for the 16 cm. distance between the teeth and the entrance of the esophagus. In the smaller Negus esophagoscope a 24 French bougie can be passed without difficulty, and even in the larger instrument a size 30 French bougie can be passed easily through the lumen of the instrument. This helps in entering the upper end of the esophagus as well as in the investigation of the constriction along the length of this rather fragile organ. In caring for cardiospasm, the larger bougie aids greatly in dilating this constriction, permitting more easily the passage of the esophagoscope. This dilatation may be all that is necessary for the relief of this condition.

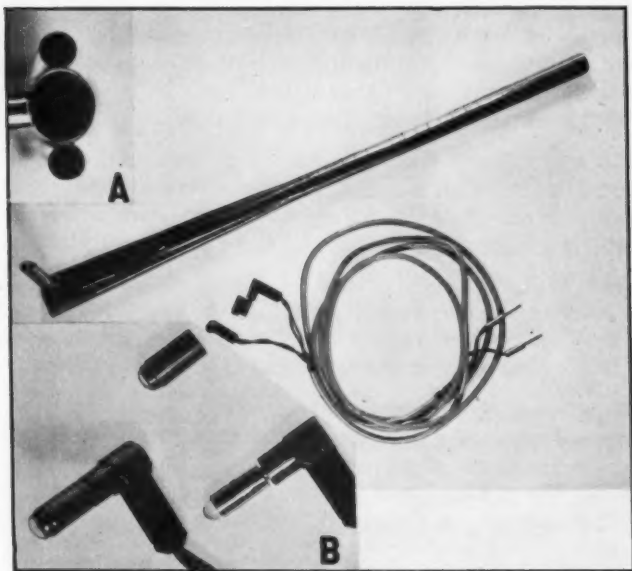
In esophagoscopy, let us have light, — all we can get of it.

An improvement in the lighting of the Negus was essential

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Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Jan. 6, 1947.

to obtain greater ease in properly viewing all ulcerations, areas of granulation and cauterization of bleeding points. To this end, I sought its modification. The Detroit Edison Company, through its research division, reconstructed the lighting for the maximum of efficiency. I am particularly indebted

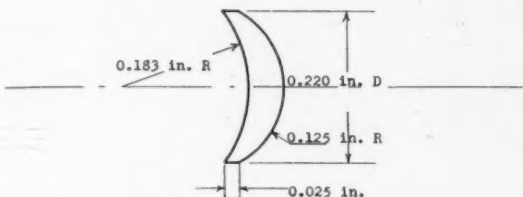
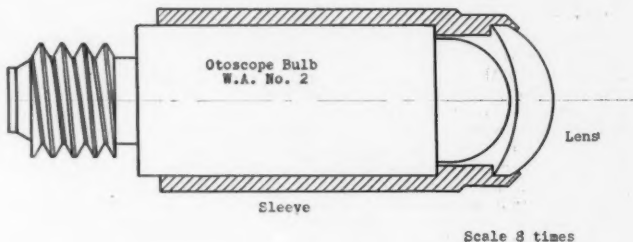


to Henry S. Walker and C. J. Shuttleworth. I give you their description of the solution of this problem:

"The Negus is lighted by means of side tubes, one on each side of the 18-inch main tube, and so arranged that their axes converge at the distal end of the main tube. The diameter of these side tubes limits the physical size of the bulb to a section of  $17/64$  of an inch. Heating of the instrument in use limits the electrical power used for each lamp bulb to between one-half and one watt. There is a commonly used bulb available in this general class, the otoscope No. 2 lamp, which has a molded condenser lens as an integral part of the bulb. This source is used in an instrument where the point of examination is only two inches or less from the lamp and the single condenser lens serves very well, but when used in the Negus its pattern is so large in area that only by greatly increasing the electrical input can sufficient illumination be projected to the

work area. At the higher level of input energy, bulb life is too short to make the system practical.

"A supplementary meniscus lens of borosilicate crown glass was designed as shown in the accompanying sketch and fitted to a split sleeve that offers secure friction grip to the otoscope bulb as shown in the assembly drawing, where the sleeve and supplementary lens are shown in section, over a standard lamp. Because of variations in filament mounting in the commercial bulbs, provision is made for focusing the combination by sliding the friction sleeve, but it will be found that in most



cases satisfactory illumination is achieved by simply pushing the sleeve against its stop, as shown.

"The outer diameter of the sleeve is such that it will not pass through the side into the main tube of the Negus, thus eliminating any possibility of dropping the lamp parts into the patient's body if the lamp should become loosened during use of the instrument.

"Each of the two bulbs is mounted in a separate socket so that rotation of the assembly in the side tube will permit correction of any axial misalignment in bulb manufacture. Thus, if there should be a portion of the field where the illumination is not of high intensity, the socket may be rotated in the tube to correct the alignment. If such rotation does not correct the illumination, that bulb should be discarded and the slip lens installed on the new bulb. The offending bulb can be discovered simply by placing the sockets in the instrument one at a time and observing the field.

The following data were taken with two lamps in a standard esophagoscope and the light values are brightness measurements on a white mat surface one inch beyond the end of the main tube; voltages are measured at the bulb contacts.

Voltage at Bulbs	Without Supplementary Lens	Illumination in Foot Lamberts With Supplementary Lens
1.5	1.6	6
2.0	6	18
2.5	18	55

"Because of the type of surface at which the brightness was measured, the values are numerically equal to the foot-candles of illumination falling upon the work area at the end of the tube. From these values it will be seen that without the supplementary lens system, even at full rated voltage on the bulbs, the light is below the 30 or 40 foot-candles needed for good vision. With the supplementary lenses in place, the illumination rises to such an extent that the bulbs may be operated at values well under their rated voltage, thus permitting them to render dependable service with long filament life. With the lenses, the angle of divergence of the beam is so slight that the illuminating system may be used in a much longer instrument than the one for which it was designed. In fact, by focusing the lens sleeve, as described previously, the pattern of the filament may be projected several feet from the bulb; the intensity of the illumination will vary as much as the area of the pattern."

This instrument has been in use at Harper Hospital for a period of two years. It has proven both efficient and practical, for it rarely gets out of order and the otoscope bulbs which are used are obtained easily and changed as easily.

641 David Whitney Building.

#### NEW YORK ACADEMY OF MEDICINE CENTENNIAL.

The New York Academy of Medicine inaugurated its Centennial Celebration with a dinner, March 6, at the Waldorf-Astoria Hotel in New York.

THE LARYNGOSCOPE congratulates the Academy on this Centennial event and on its splendid achievements throughout this century of medicinal progress. This is an enviable record, worthy of emulation and a challenge to the future.

